GENERAL LIBRARY
SEP 18 1914

SCIENTIFIC AMERICAN

GERMAN MILITARY PARSEVALS PASSING THE COLOGNE CATHEDRAL

How Great Britain Trains Her Military Aviators
An Automobile Military Wireless Station
Time as a Factor in Baseball

Vol. CXI. No. 12
September 19, 1914

Munn & Co., Inc., Publishers
New York, N. Y.

Price 10 Cents
$3.00 A Year

HUDSON Six-40 1915 Model $1,550 This Year F.O.B. Detroit

Howard E. Coffin
Chief of the 48 Hudson Engineers

The Final Authority

On New-Day Quality Cars

The new HUDSON Six-40—like all former Hudsons—is a Howard E. Coffin creation. So were cars before Hudsons—cars which marked some of the greatest steps in motor car progression.

Legions of men who have owned these cars regard Mr. Coffin as final authority in this line of engineering. So do legions of others who have watched motor car evolution.

Do *you* know another designer who has accomplished so much, or has led in so many advances?

Go See His Ideal Six

The HUDSON Six-40 for 1915 is the finished model of Mr. Coffin's ideal car. It shows his final conception of the new-day type.

He has worked for four years on it. So have 47 other HUDSON engineers. Thus this HUDSON Six-40 is their composite idea of the modern high-grade car. It is their latest and best, in big things and little—in beauty and in mechanism, in equipment and detail.

If there are faults or shortcomings—if any car excels it—then these 48 engineers are mistaken. But that isn't thinkable. You will find in this HUDSON Six-40 the representative car of today.

It Differs in Degree

The HUDSON Six-40 is not unique. It is simply in advance of others in the almost universal trends.

Practically all of the upper-class cars are now Sixes. And that designer is rare who doesn't consider the Six as his final goal. It meets his ultimate object—continuous power.

Lightness is a common trend. The old excesses—due to wrong materials or crude designing—are being rapidly wiped out. The HUDSON engineers—in this 2,890-pound car—have merely excelled their rivals.

Low operative cost is sought for by makers and users alike. But the HUDSON Six-40 saves more than others, by record lightness in this class and by a new-type motor.

All aim at beauty, comfort and attractions in equipment. But 48 designers have worked four years in perfecting the HUDSON refinements.

And the price trend is generally lower. Larger production and standardization make this expected and possible. But the new HUDSON Six-40—selling $200 lower than last year—best shows what efficiency can do.

Five Bodies—No Delays

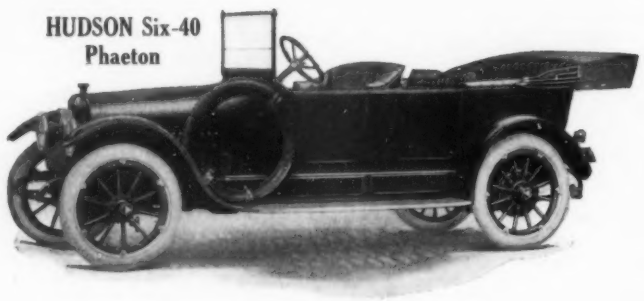
The HUDSON Six-40 is built this year with five beautiful new-style bodies. Note the list below. Each offers countless up-to-date attractions, some of which are exclusive to this car.

With our trebled output this year we are coping with demand. We go to extremes to save delays to our buyers. Up to this writing, 45 per cent of all this season's shipments have gone out by express—trainloads to single cities.

Today you can get prompt delivery, despite this car's amazing popularity. Go see your HUDSON dealer. If he cannot deliver a car at once, he will see that you don't wait long.

Hudson dealers everywhere. Catalog on request.
7-passenger Phaeton, $1,550, f. o. b. Detroit.
3-passenger Roadster, same price.
Cabriolet, $1,750—Coupe, $2,150—Limousine, $2,550.
Canadian Prices: Phaeton and Roadster, $2,100 f.o.b. Detroit, duty paid.

HUDSON Six-40
Phaeton



HUDSON MOTOR CAR COMPANY, 8207 Jefferson Avenue, DETROIT, MICH.

SEVENTIETH YEAR

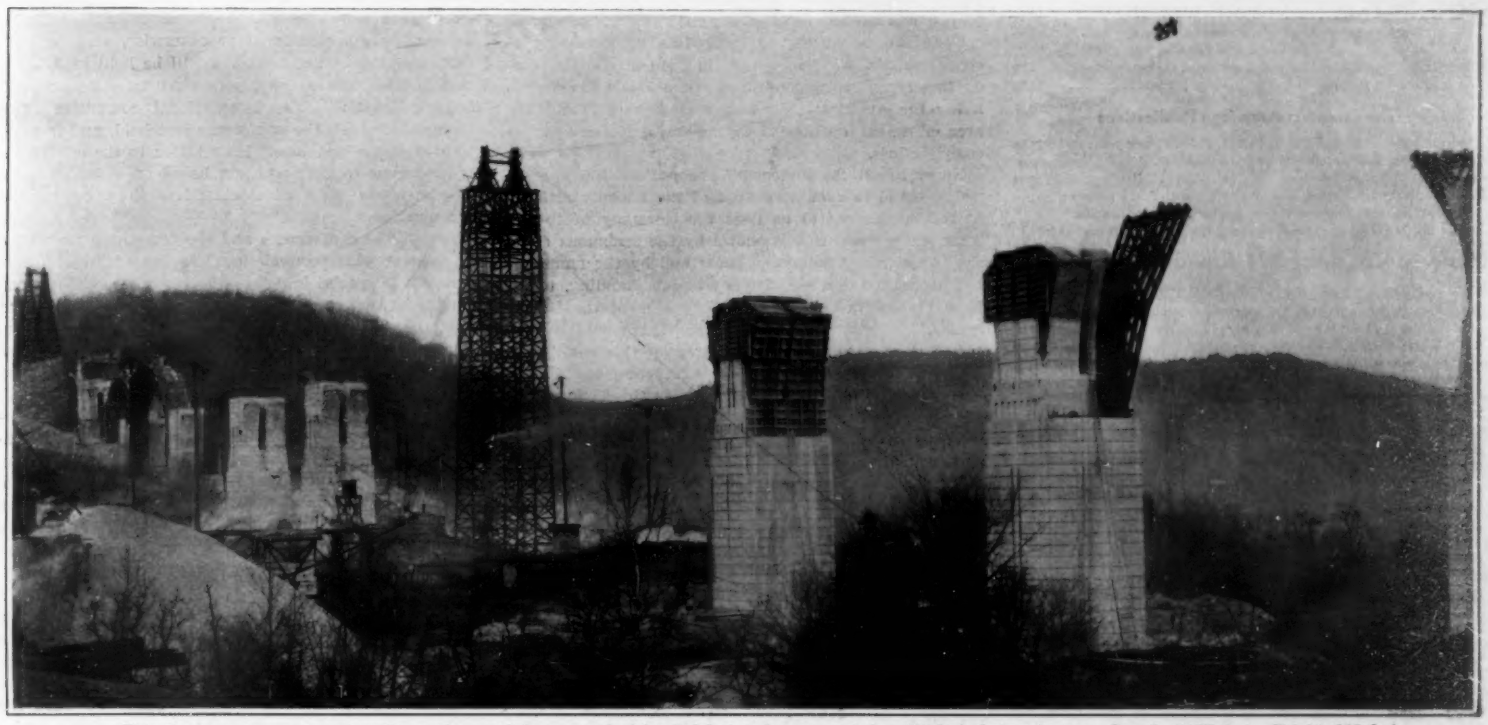
SCIENTIFIC AMERICAN

THE WEEKLY JOURNAL OF PRACTICAL INFORMATION

VOLUME CXI.]
NUMBER 12.]

NEW YORK, SEPTEMBER 19, 1914

[10 CENTS A COPY
$3.00 A YEAR



This, the largest concrete arch bridge in the world, is composed of ten 180-foot arch spans and two 100-foot abutment spans. Length, 2,375 feet. Height, 242 feet.

Constructing the piers of the Tunkhannock Creek Viaduct.

The arch to the left is completed, ready for the superstructure, the falsework being still in place. To the right is seen the steel falsework and forms for the adjoining arch.

Construction of the Tunkhannock Creek Viaduct.—[See page 224.]

SCIENTIFIC AMERICAN

Founded 1845

NEW YORK, SATURDAY, SEPTEMBER 19, 1914

Published by Munn & Co., Incorporated. Charles Allen Munn, President; Frederick Converse Beach, Secretary
Orson D. Munn, Treasurer
all at 361 Broadway, New York

Entered at the Post Office of New York, N. Y., as Second Class Matter
Trade Mark Registered in the United States Patent Office

Copyright 1914 by Munn & Co., Inc.

Subscription Rates

Subscription one year	$3.00
Postage prepaid in United States and possessions. Mexico, Cuba, and Panama	
Subscriptions for Foreign Countries, one year, postage prepaid.	4.50
Subscriptions for Canada, one year, postage prepaid	3.75

The Scientific American Publications

Scientific American (established 1845) ..... per year.	$3.00
Scientific American Supplement established 1876. " "	5.00
American Homes and Gardens ..... " "	3.00

The combined subscription rates and rates to foreign countries including Canada, will be furnished upon application
Remit by postal or express money order, bank draft or check

Munn & Co., Inc., 361 Broadway, New York

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

The purpose of this journal is to record accurately, simply, and interestingly, the world's progress in scientific knowledge and industrial achievement.

Illegal Mining and Bomb-dropping

WAR, in spite of the fact that it is the supreme exhibition of brute force, has its ethical rules of conduct; and the frightful game will be played fairly or foully, according to the humanity and sense of honor of the nations engaged.

It has been the constant aim of philanthropy to prevent war, altogether, or, failing that, to mitigate its savagery, and to shield the non-combatant civilian, so far as may be, from its horrors.

There has grown up, through the centuries, a code of practices and prohibitions designed to protect the non-combatant, which of late years has been revised and amplified by The Hague convention.

Long before this convention was drawn up, it had been agreed among the civilized nations that the attack of artillery upon fortified cities should be confined, as far as possible, to the engirdling fortifications, the trenches, camps, and other military elements of the defense, and that the thickly populated city itself should be spared. If military necessity called for the bombardment of the city, it has been customary among civilized nations to give notice of the fact, so as to afford time for the withdrawal of the civilian population.

The wave of indignation which swept around the world, when it was learned that a Zeppelin airship had stolen by night across the sleeping city of Antwerp and dropped high-explosive shells upon its civilian population, was a protest against a revival of the methods of war of the middle ages. Had the shells been aimed at one of the outlying or interior fortifications, or at the barracks, or the camp of the Belgian troops, so far from execrating, the world would have applauded the feat as one of aeronautical skill and daring, and as giving additional evidence of the military usefulness of the airship. But to kill in their sleep the unarmed citizens of a state whose only cause of offense was that it objected to its domain being turned into a cockpit in which its neighbors could settle their quarrels, is to add a spice of vicious ferocity to the attitude of Germany toward a weak and unoffending people.

As upon the land, so upon the sea has Germany seen fit to ignore those rules of The Hague convention, which Germany signed, and which seek to mitigate the cruelties of war, so far as they affect the non-combatants both of the enemy and of neutral states. The Antwerp bombs find their counterpart in the mine-strewn waters of the North Sea—one of the most crowded thoroughfares of the peaceful commerce of the world.

The strewing of mines over the course followed by the enemy during an engagement, or the planting of mine fields for the protection of a country's own channels, harbors, ports, and dockyards, is recognized as a perfectly justifiable means of attack and defense.

This was done on both sides with deadly effect during the Russo-Japanese war. But during that war, and for many months afterward, the floating mines which had been dropped by the Russians and Japanese remained afloat, and drifting in the ocean currents, caused the destruction of many merchant vessels, often at great distances from the point at which the mines were first planted or dropped overboard.

The Hague convention attempted to remove this menace to the shipping of the world by rendering it obligatory so to arrange the mechanism of the mines that they would become ineffective after a certain period of time had passed.

This merciful provision Germany apparently has seen fit to ignore. She has sent her mine-ships out and has strewn the North Sea with mines, which, drifting far and wide, have caused the loss of a large number of the merchant ships, not merely of the enemy, but of neutral states. On the chance of sinking one warship of the enemy, Germany is willing to sink half a dozen unoffending merchant ships of the few maritime states with which she has no quarrel.

That she is willing to incur this responsibility is characteristic of the spirit in which she is conducting her naval and military operations. Every ship flying the American flag that may have to enter the area of naval operations is liable to disablement or complete loss.

Never in all the history of the nations did a great people stand in such sore need of the friendly attitude of the outside world as does the Germany of to-day. That she realizes this is shown by the strenuous effort she is making through the press and by the mouth of her accredited representatives of high standing, to set herself right in the eyes of the people of the United States.

But what would be the effect upon this country if the news was flashed over the wires that the United States ship "Tennessee," let us say, in the performance of her errand of mercy, had struck a floating mine upon the high seas and gone to the bottom?

An Internationalized Science

PERHAPS because meteorology is essentially world-wide in its outlook, and depends to a much greater degree than most other sciences upon international co-operation, it has developed a formal international organization of exceptional strength and authority. Even in this age of scientific solidarity, which has produced the International Association of Academies, the International Institute of Agriculture, and the International Catalogue of Scientific Literature, the International Meteorological Organization deserves special recognition as an example of concerted effort between workers of diverse lands and tongues, the more particularly because it has no political backing to give force to its decisions. The participants in international meteorological meetings are not accredited representatives of governments, and the meetings are therefore unofficial. Nevertheless, the intellectual supremacy of the organization is so fully recognized by meteorologists throughout the world that this body has almost the character of a world-parliament; a character that it could never have assumed if its deliberations were not limited strictly to practical questions. The organization is not a sacred college, prescribing to meteorologists what they shall believe. It concerns itself with methods of observation, instruments, units, definitions, symbols, weather telegraphy, storm signals, and all questions of organization and co-operation. The definite direction of research is attempted only to a limited extent, and then through special commissions of recognized experts who would, even without formal organization, be the leaders in their several lines of investigation.

International organization in meteorology may be said to date from the latter part of the eighteenth century, when the Meteorological Society of the Palatinate, with its headquarters at Mannheim, Germany, established a system of observations on a uniform plan at stations all over Europe, as well as at one in America, and published the results in its Ephemerides (1781-1792). The first assemblage of meteorologists from the leading countries of the world to discuss methods, apparatus, and the like, was, however, the International Maritime Conference held at Brussels, in 1853, "for devising an uniform system of meteorological observations at sea." This conference was held at the invitation of the United States Government, and its leading spirit was Lieut. Maury.

The existing international organization traces its origin to a meteorological conference held at Leipzig, in 1872, at the suggestion of Drs. Bruhns, Wild, and Jelinek. This was convoked unofficially, and was regarded mainly as a preliminary to the First International Meteorological Congress held the following year at Vienna. In its Vienna congress, as well as in the second congress, held at Rome in 1879, meteorology followed the plan which is still customary in other sciences of inviting the various governments, through diplomatic channels, to send regularly accredited delegates to the meeting, the expectation being that greater authority would thus be attached to the decisions reached than could be attained by any unofficial body. This plan was, however, found to be attended by certain disadvantages, the most serious of which was that the delegates appointed by the governments were not, in many cases, such persons as would have been chosen by a plebiscite of meteorologists in the several countries. Some of them were not even identified in any way with meteorology. Very valuable work was done, nevertheless, at both congresses. At the Vienna meeting a "permanent international committee" was appointed, and this held meetings in 1874, 1876, and 1878. The International Meteorological Committee in its present form was appointed at the Rome congress. It has, in recent years, consisted of seventeen members, all of whom are directors of national meteorological services, and it meets about every three years.

Since 1879, instead of official congresses of meteorology, there have been held private conferences of meteorologists who are at the head of meteorological services, whether national or otherwise, viz., in 1891, 1896, and 1905. The next one will be held in 1915, in case political affairs in Europe shall have become sufficiently tranquil. The international committee holds its mandate from the conference last held, and is reappointed at the next one. Its relation to the conference is analogous to that which a board of directors holds to the whole body of stockholders in a commercial organization.

Lastly, the conferences and the committee from time to time appoint "commissions" to organize and direct research in special branches of meteorology. The membership of these commissions is not limited to directors. Commissions now exist on terrestrial magnetism, scientific aeronautics (i. e., aerology), radiation, solar investigations, weather telegraphy, maritime meteorology and storm warnings, and agricultural meteorology.

It should be noted that there have been a few international congresses of meteorology which had no connection with the permanent organization above described. One of these was held at Chicago in 1893, and another at Paris in 1900. It was intended to hold an open congress of this character at Venice this autumn.

The Right Time to Eat

THAT we eat at exactly the wrong time, at least in some countries, is the somewhat remarkable conclusion which Prof. Bergonié of the Bordeaux University reaches as the result of his researches, and this is very apropos at this time when we have the Taylor system of best use of the human motor. Again, in an electric station, the engineers regulate the coal consumption so as to concord with the variable demand for current. But human beings, according to him, although they work at stated hours, carry out the absorption of food quite by chance and without being occupied with making the food supply concord with the periods of most work. Fortunately, the liver acts as a reserve of energy, owing to its glycogenic function, but its capacity is, of course, limited. Take, as an example, a repast composed of 1 part fatty elements, 1 part of proteids (meat), and 4 to 5 parts carbohydrates (sugar, starch, etc.); the utilization of the energy commences almost at once, and the amount of energy available increases up to some three hours after absorbing the food, then it decreases slowly. According to this, it follows that most Europeans and Americans use exactly the wrong hours for taking their repast, that is, from 12 to 1 o'clock and from 7 to 8, for the early morning breakfasts (coffee, etc.) can hardly be counted. Especially to be remarked is that the evening meal acts to produce energy just when the organism is about to rest for a long period, and this can only act to overload the liver, being unused for a long time. According to Prof. Bergonié, the principal repast should be taken at 7:30 A. M., and should be completed by two others, of lighter nature, taken at 4:30 and at 8 o'clock P. M. We would remark that in France and some other countries an early morning repast would not be practicable on account of an absolute lack of appetite for heavy food which is felt at that time, at least by a great number of persons. The Romans had the same habit, so that this must be due to the effect of climate, as it does not depend upon the race of the person who may at any time inhabit such countries.

How to Use the Scientific American's War Maps

THE war maps which were published in the September War Number of the SCIENTIFIC AMERICAN should prove of great value in studying the present conflict from day to day if they are properly used. We have found that if they are pasted upon stout cardboard, the positions of the contending armies can be very clearly indicated by means of pins with different colored heads. As soon as trustworthy reports of movements are received, it is an easy matter to shift the proper pins to the new positions which the armies that they represent occupy. Thus one obtains at a glance some idea of the extent of the fighting lines in the present conflict as well as of the strategic importance of the positions held by each force.

Electricity

Electricity for the Household in Venezuela.—The electric power company which has been supplying the city of Caracas, Venezuela, with electric light, has recently installed day service, and hopes to educate the people to the use of electric stoves, irons, fans, etc. Electric heat and power are ideal for tropical countries. It may take some time to educate the Venezuelans to its advantages, but eventually it should prove indispensable.

Copper and the War.—For the last five years the consumption of copper in this country has been from 63 to 67 per cent of that produced by the mines of the United States. Fifty per cent of the copper refined in this country has been exported largely to countries that are now at war. Evidently then the present turmoil in Europe will have a material effect upon the copper production in this country which will make itself felt in the electrical industries, which are the principal users of this metal.

Electric Heating for Bakers' Ovens.—A recent use of electricity relates to heating of bakers' ovens, and the process is coming into favor as a clean and economical one. Some of the leading electrical works are making this class of apparatus on an improved design. Such plants are adapted also for use on shipboard, and here they are still more to be recommended. In some countries the vessels have been using electric heating for ovens for some time past, and experience shows that it is very well adapted for the purpose.

Street Car Tires of Rubber.—In order to reduce the noise of street cars, and particularly the flat wheel nuisance, it was suggested at a recent meeting of the Tramways Association, in Newcastle, England, that street cars be provided with tires of rubber. It was argued that the wear on the rails would be much reduced, and the life of the rubber tire would exceed that on motor trucks and buses, which are credited with an average life of twenty thousand miles. It was also argued that a higher rate of speed would be possible with the flexible tire.

Lisbon's Time Signals.—Correct time is announced every even hour in the port of Lisbon, Portugal, by means of two lanterns placed on iron columns 100 feet high. The lanterns each have three faces, measuring 6.5 feet by 8 feet. At exactly five minutes before the hour, a horizontal line of light appears on each face, and on the tick of the hour, this light is extinguished. The signals may be seen even in the day-time at a distance of a mile and a half. At night the position of the lanterns is indicated by three red lights. The signals are worked electrically under the control of a clock in the Observatorio Astronomico de Lisboa.

Electrical Exports and the War.—A recent issue of the *Electrical World* contains tables showing the value of American electrical exports from July 1st, 1912, to June 30th, 1913, for countries now at war, and those not at war. They show that exports for countries now at war were somewhat more than $2,225,000 worth, in other words, one tenth of our total electrical export trade. The other nine tenths went either to ports that are at present neutral, or to the colonies of countries now at war. Because they are cut off from other sources of supply, these colonies and neutral countries should demand a much larger share of our trade.

Electrical Safety Rules.—The Bureau of Standards has been making a study of safety rules and practices in the construction, installation and maintenance of electrical equipment, and has found that such companies as do have safety rules have based them on limited and inadequate experiences, while many companies have no rules because of the expense and difficulty of preparing them and because they are not compelled to take precautionary measures by the State authorities. Accordingly the Bureau has prepared a set of rules based on a thorough study, with the aid and advice of State commissions, companies employing electrical equipment, and workmen. The rules are published in Circular No. 49.

Incandescent Lamps for Railroad Lighting.—The new metal filament lamps of high candle-power are likely to take the place of arc lamps for outside lighting in many cases, and one of these is for the lighting of railroad yards. A good example is a large freight station and yard on the Continent which was newly installed last fall. Current at 6,000 volts comes from an outside electric plant into a transformer house where it is reduced to 200 volts. For the lighting which is needed for loading and unloading of freight there are used 24 ironwork poles, each 26 feet high and carrying a 300 candle-power metal filament lamp, while the lighting of the outer tracks comprises 14 similar poles 40 feet high with the same lamps. In other places, 50 candle-power lamps are employed. A suitable device allows of lowering the lamps from the poles when they are burned out, but ordinarily they require no trimming as in the case of arc lamps. A small winch and steel cable lowers the lamp in about the same way as an arc lamp, so that a new lamp can be readily put in. For use inside of freight cars, sets of hand lamps on flexible cables are used, the cables working by trolley upon wires stretched alongside the tracks.

Science

Nebular Motion.—Recently Dr. Slipher, of the Lowell Observatory, detected for the first time that the Virgo Nebula (N. G. C. 4,594) had a radial velocity of 1,000 kilometers a second, and a rotation of about the same; and now C. O. Lampland, of the same institution, has discovered the proper motion of the same nebula, that is, its motion in relation to the other heavenly bodies, this being the first determined proper motion among the nebulae. The nebula observed is the one that looks like the planet Saturn, with a black lane through it.

Paris Academy Continues its Meetings.—The French Academy of Sciences is still continuing its meetings, so that we will be able to keep up our news from this body. At the last meeting M. Francotte, professor at Brussels University, telegraphed his thanks for the sympathy which the Academy expressed to that nation at a previous meeting. A paper was presented about the last eclipse of the sun by Messrs. Baillaud and Bigourdan, of the Observatory. M. Laveran communicated a note from M. Danitz on treatment of sleeping sickness by arsenical compounds.

A Spanish Institute of Oceanography has recently been established by royal decree, under the direction of Prof. Odón de Buen, for the purpose of carrying on investigations in the waters adjacent to Spain, including practical studies relating to fisheries. The institute, which has its headquarters at Madrid, has absorbed the laboratory of marine biology in the Balearic Islands and the stations of marine biology at Santander and Malaga. Additional stations are to be established at Vigo and in the Canaries. An oceanographic museum and an aquarium will form parts of the establishment at Madrid. The institute undertook a cruise in the Mediterranean this season.

Agricultural Co-operation in the Philippines.—There are nearly a million small farmers in the Philippines, and as yet little has been done toward organizing any kind of co-operation among them. The need for such co-operation is now to be met on a comprehensive scale. According to a plan inaugurated by Vice-Governor Martin, a provincial agricultural society is to be organized in each province. Delegates from the provincial societies will meet in Manila and organize an insular agricultural society. On the other hand, each provincial society will endeavor to create a local agricultural society in each municipality of its own province. The whole system will be closely affiliated with the official Bureau of Agriculture, and the Director of Agriculture will be *ex officio* president of the insular society. Several insular councils will be established to promote individual rural industries. Thus there will be insular councils for rice, tobacco, cocoanut, abaca, live-stock, and maize.

The Meteorological Service of Formosa was organized under an ordinance of the Japanese government in 1896, and placed under the Bureau of Communications of the colony. In addition to the central observatory at Taihoku, the service has observatories at Taichu, Tainan, Koshun, Hokoto (Pescadores Islands), Taito, and Sharyoto (at the mouth of Keelung harbor). Observations are also taken at 10 lighthouses, and there are 100 rainfall stations scattered over the island. Weather telegrams are regularly received at Taihoku from all the observatories of the service, as well as from numerous stations in Japan and on the China coast, and from Manila. Weather maps are compiled, and weather forecasts and storm warnings covering the whole island are issued daily. All observatories in the island are provided with Gray-Milne and Omori seismographs. The service has just issued a comprehensive work on the climate, typhoons, and earthquakes of Formosa. A novel fact brought out by this work is that the station of Kashoryo, near Keelung, has the remarkable annual rainfall of 288.9 inches, and is probably the wettest place in the Far East.

The End of a North Polar Expedition.—A press dispatch, dated September 1st, reported the arrival at Archangel of the surviving members of the expedition which left Russia in the autumn of 1912, under Capt. Sedov, in the hope of reaching the North Pole by way of Franz Josef Land. The survivors report the death of their leader from illness, while attempting to sledge north from Franz Josef Land. This expedition was financed chiefly by the well-known St. Petersburg newspaper, the *Novoya Vremja*, and was generally believed to be badly equipped when it started north. The undertaking was not favored by the Russian government. Sedov's previous Arctic experience had included an expedition to the mouth of the Kolyma in 1909, and one to Nova Zembla in 1910, but the impression prevailed when he left Russia on his final journey that neither he nor his men had sufficient skill, training or equipment to give hope of valuable results from their expedition. The winter of 1912–13 was spent at the Pankratiev Islands, off the northwest coast of Nova Zembla. The following summer, eight of the twenty-two members of the expedition were obliged to return to Russia on account of illness. The others were supposed to have sailed for Franz Josef Land, but as no further tidings were received of them the Russian authorities recently sent an expedition in search of them on the steamer "Hertha."

Aeronautics

Another Stabilizer.—In a patent, No. 1,106,804, Belton J. Hamilton, of London, England, presents an aeroplane the two sides of whose plane are so constructed and connected that an excess of air pressure on one side will produce automatically a stabilizing action on the other side.

Another Protecting Garment for Aviators.—Richard Kockrow, of Nieder, Lausitz, Germany, has secured a patent, No. 1,104,808, for an aviator's protecting garment formed of layers of felt and aluminium, spring spaced apart to protect the wearer from the shock in case of a fall.

Pneumatic Suit for Aviators.—Nazaire Lacrotte, Paris, France, has patented, No. 1,105,569, a pneumatic suit for aviators, motorists and the like, having helmet, dress-plate, thigh protector and shin guards of special construction, and suitably connected so they will be maintained in proper position upon the wearer.

Aids in Directing an Aeroplane.—In a patent, No. 1,104,542, James Robertson Porter, of Holborn, London, England, presents an aeronautical machine in which air is drawn in from the upper end by a fan and expelled downwardly and which has a conical deflector and flaps controlling the discharge of the air according to the direction of travel desired.

Providing Stability Planes in Series.—Walter L. Marr, of Flint, Mich., in patent, No. 1,104,056, provides stability planes at intervals along the under surface of the upper main plane with their centers of resistance above the center of gravity of the machine and operating to aid in arresting or preventing a lateral movement of the machine if the main planes up-tilt laterally.

A Zahm Flying Machine Improvement.—Alfred Francis Zahm, of Washington, D. C., has secured a patent, No. 1,107,231, for a flying machine in which a plurality of lateral ailerons are moved to different angles relatively to each other by means which permit the ailerons automatically so to adjust themselves under the varying impact of the air as to receive equal pressure.

Another Flying Machine Improvement.—Patent, No. 1,106,061, to Josef Schroeder, Tegel, Germany, assignor to General Electric Company, is for improvements in flying machines which supply wings pivoted or hinged at their front ends and elastically supported at some point in rear with the especial object of maintaining the lower or supporting stand wires under constant tension.

An Improved Flying Machine.—A patent, No. 1,105,941, for flying machine, has issued for the invention of John Francis Tiner, of Uvalde, Tex., in which the inventor seeks to provide for the more efficient utilization of artificially produced air currents than in the apparatus commonly employed, by means of axially elongated propellers for moving the air current with greater force.

Aeroplane Balancing Devices.—Patent, No. 1,106,099, to Frank T. Jones, of Baltimore, Md., seeks to secure the automatic balancing of an aeroplane by combining with a plurality of independently pivoted balancing planes at desired locations on the machine a universally movable pendent member connected with such planes to automatically move them, some in one and others in another direction.

A Wireless Telegraph Installation for Aeroplanes.—L. Rouzet, of Paris, has patented, No. 1,106,729, a wireless telegraph installation for aeroplanes especially designed with a view to protecting the aviator against fatal or other electrical shocks because of such installation. In fitting up the aeroplane with a floating antenna, provision is made for insulating all the fixed parts of the installation.

Aiding Equilibrium by Adjusting Propeller Blades.—In a patent, No. 1,104,039, for a flying machine, the invention of Carl Dienstbach, of New York city, the inventor utilizes, in connection with an aeroplane, a propeller with pivoted blades whose angle of inclination can be changed at will by the aviator to give a positive or negative lift to the part where the propeller is located, for controlling the equilibrium.

A New Glenn Curtiss Flying Machine.—Glenn H. Curtiss, in patent, No. 1,104,036, provides various details of construction applicable to both aeroplanes and hydro-aeroplanes including a frame adapted to be moved by the swinging of the aviator's body for operating equilibrium restoring devices, and a second laterally movable frame for another operator, which second frame may be placed in or out of operative relation to the equilibrium restoring devices.

Aeroplanes in the Arctic.—The two expeditions sent north this summer by the Russian authorities to seek missing Russian exploring expeditions—viz., the "Hertha," which is looking for the Sedov expedition, and the "Eclipse," which is seeking the Brussilov and Russanov expeditions—are equipped with aeroplanes, the use of which, in connection with polar expeditions, has been much talked of during the past two years, but has not yet been actually attempted. As previously reported in these columns, aeroplanes are also expected to figure in the expeditions of Payer (1914) and Amundsen (1915).

The massive steel falsework for the 180-foot arches was built in sections in the shops, shipped to the site, and erected by means of a double cableway.

Tunkhannock Creek Viaduct.

The Tunkhannock Railway Viaduct

Construction of the Largest Concrete Arch Bridge in the World

THE Delaware, Lackawanna & Western Railroad is engaged in reconstructing forty miles of its system between Clark's Summit, Pennsylvania, and Hallstead. The significance of the work lies in the fact that the company, in eliminating curvature and reducing grades on this section, is willing to expend $12,000,000, having estimated that the reduction in the cost of operation of the new as compared with the old line will render this great expenditure a profitable investment.

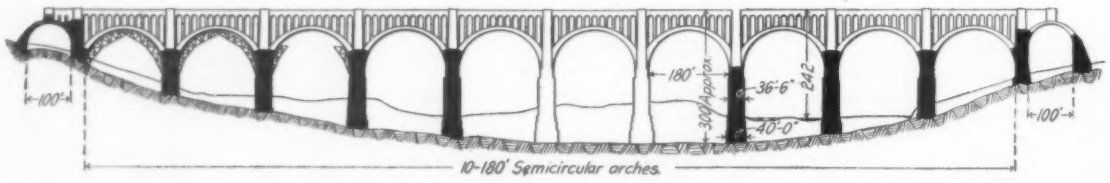
The work is of a heavy character throughout; but the two most notable and picturesque structures are the concrete viaducts, one over Tunkhannock Creek and the other over Martin's Creek, the former calling for 157,000 cubic yards of concrete and the other for 78,000 cubic yards.

The improvement includes among other things the elimination of twenty-two grade crossings, in which all the structures carrying the roadbed will be of concrete wherever there is sufficient clearance to permit of its use. Altogether, if we include the material in these minor structures, of which there are eighty, the railroad company is using in this stretch of forty miles a total of 400,000 yards of concrete.

The Tunkhannock bridge has an extreme length over the masonry of 2,375 feet, and its height from the bed of the stream to the top of the coping is 242 feet, and from rock foundation 300 feet. The bridge consists of ten semi-circular arched spans, each 180 feet in the clear between piers, and of two 100-foot semi-circular abutment spans, which are of sufficient width to carry two railroad tracks. As will be seen from our illustration, the main arches and the piers are of massive construction. The superstructure of the arches to the coping, consists, for each span, of ten vertical members rounded off into as many small semi-circular arches which carry the roadway. In addition to the 167,000 cubic yards of concrete, there were used in this bridge, 2,275,000 pounds of reinforcing steel, and 43,500 cubic yards of material had to be taken out for the foundation. All of the piers, which measure 36 feet 6 inches by 43 feet 6 inches, are built solid below the springing line. And all piers are carried down to rock, which was reached at a depth of from 10 to 95 feet below ground level. Hence the extreme height of the highest pier from bedrock to coping was 300 feet.

As will be seen from our illustration the falsework for carrying the arches during erection was of very high character, consisting of four spans of arched trusses, which were built in sections at the shop, transported to the site, and erected by means of a double aerial cableway, as shown in one of our illustrations.

The design is of very simple and appropriate outline, and the bridge as completed will form one of the most monumental engineering works in existence.



Elevation of Nicholson Viaduct, showing progress to November 1st.

Marine Oil Spreader

THE value of oil for calming rough seas has long been recognized. The reason it is not more extensively used is probably because few vessels are provided with special apparatus for distributing the oil properly. When in time of extreme distress a vessel finds it necessary to use some method of quieting the waves, the only means of distributing the oil is to pour it down the scuppers, or as is sometimes done to fill a canvas bag with oil, perforating the bag so that the oil can escape, and hang the bag over the side of the ship. Sometimes a hose is used to distribute the oil. The difficulty with these methods is that the oil is discharged in the wake of the drifting ship, and as the oil spreads comparatively slowly, the ship is constantly moving out of the quieted area. Recently H. W. Stocking of San Francisco has devised an oil distributing apparatus which permits of distributing the oil where needed, and far enough from the vessel to quiet the sea measurably before it reaches the vessel. Furthermore, the amount of oil discharged may be controlled accurately from the vessel. The apparatus consists merely of a sea or drag anchor which may be let out from the ship to the required position, and which also carries a flexible pipe line terminating in a nozzle. The oil is delivered through this pipe line to the nozzle, where it is discharged. The distribution of oil may be controlled by throttling the pipe line. The sea anchor, which may be of the usual conical form, preferably with an opening in the small end of the cone to prevent the anchor from swaying, serves to retard the drift of the vessel enough to keep it within the area affected by the oil. As the oil is distributed to windward at a considerable distance from the vessel, this distance being directly under the control of the ship, it may be discharged at the proper point to quiet the waves before they reach the vessel.

Improved Castor

THE principal objection to the ordinary castor is the fact that a hole must be bored in the furniture leg to receive the shank of the castor or the socket if the castor is of the socket type, and when the shank or the socket is hammered into place as is necessary to prevent it from dropping out, there is danger of splitting the wood. To avoid this S. Rummel of this city has invented a new castor consisting of two parts, one of which is secured to the furniture by means of an ordinary screw. This part has a dome-shaped face, and it may be used as a so-called "dome of silence." However, the periphery of this member is threaded to receive the socket of the castor proper. Owing to this threaded connection, there is no danger of the castor's falling out when the furniture is lifted. When desired the castors may be unscrewed and furniture moved by sliding it on the dome-shaped members.

How Great Britain Trains Her Military Aviators

The Central Flying School

By Major H. Bannerman-Phillips

English Military Correspondent of the Scientific American

Photograph by courtesy of *Flight*.

A general view of the hangars at Upavon, on Salisbury Plain, England.

THE Central Flying School at Upavon, on Salisbury Plain, is a very important part of the organization for military aviation in that it is intended as a center of instruction for both the naval and military services. That it was in the nature of an experiment goes without saying, but its success has justified its inception, thanks to the personality of the officers who were placed in charge of it from the first. The situation is open and notoriously windy, a circumstance which, in contradistinction to many otherwise preferable, and from the point of view of learners, more attractive, flying grounds on the continent of Europe and elsewhere, affords a more suitable area for training men who will be expected to go out in practically all weathers, according to the exigencies of the service.

The buildings devoted to aeronautics number about sixteen sheds of different capacities, offices, lecture rooms, repair shops, and a department of meteorology, but the government has also already commenced the erection of permanent buildings, including quarters for the permanent staff officers, of whom there are thirteen, with four assistant instructors, two from the Navy and two from the Army, with a large permanent staff of mechanics. The school is organized for instruction in four flights, in each of which the machines are of one type at present, but pupils are shifted and changed about from one flight to another in accordance with their proficiency, in order that they may acquire a knowledge of all the types used in the air services. Flying begins with the dawn, say at 3:30 A. M. or 4 A. M., and goes on till about 8 A. M. After that work is performed in the workshops and sheds until noon, followed by a lecture before the midday meal. Two hours rest is allowed in the afternoon in view of the necessity for exceptionally early rising, and from 5 P. M. to dusk flying goes on once more. Physically and mentally it is distinctly a strenuous life, but healthy.

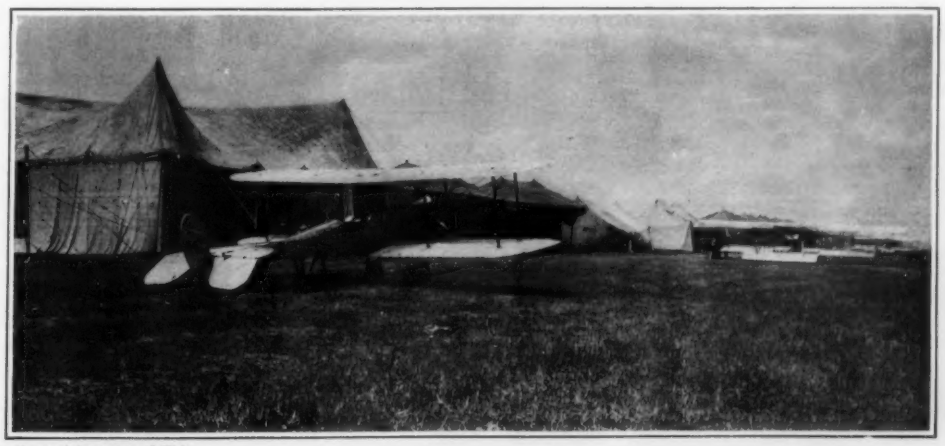
During the month of June there was a special concentration camp for airmen at Netheravon, which was attended by five squadrons of military aeroplanes coming from all parts of the country, besides the Kite Section, the Aircraft Park, and the various headquarters aeroplanes. Altogether seventy machines were available.

The move of the squadron stationed at Montrose was made the occasion of a test march across country under active service conditions, keeping in touch with the transport—a very different matter to the mere concentration of aeroplanes from various stations by way of the air alone, without the hampering condition of having to be met by their transport at the end of each day's journey, like the movement which was so brilliantly carried out not long ago by the German air service. The scheme of the Montrose squadron involved daily flights on the part of the machines of only 80 to 100 miles, but the whole of their motor transport had to meet them in camp at the end of each day, carrying everything that would be required for upkeep and repairs. The transport train included no less than twenty-three motor vehicles of all sorts, and traveling at intervals of 200 yards, they covered about two and one half miles of road while in progress, and had to move a distance of 600 miles between Montrose and Netheravon, and as their freight included spare parts for every one of the twelve aeroplanes of the squadron and four spare engines, it may be realized that it was not light. Although there was a regrettable and fatal disaster, through fog, at Northallerton, when two officers unfortunately lost their lives on duty, the journey, as a whole, was successful and instructive. Normally each squadron of military aeroplanes has a strength of 19 officers, 2 warrant officers, 21 sergeants, and 115 rank and file, and requires a transport train of 38 vehicles, and the transport for such an assemblage of aircraft which encamped at Netheravon this year would include 42 light motor vehicles, 36 heavy tenders, 36 motorcycles, 36 trailers, 12 supply lorries, 24 repair lorries, 18 shed lorries, 24 reserve equipment lorries, altogether a total of 228 vehicles, which if spaced at 200 yards while on the march, would cover 26 miles of roadway.

The work of the Concentration Camp opened on June 2nd with a conference of all officers, at which the commanding officer explained briefly the objects of the camp, viz.: to test in various ways the degree of training of the "personnel" both on the ground and in the air, the work and handling of aircraft and transports and experiments of numerous sorts; also the study and co-ordination by means of lectures, discussions, conferences, and specially de-

Photograph by courtesy of *Flight*.

A group of pupils with their instructors.



Photograph by courtesy of *Flight*.

Ready for a vault into the air at dawn.

tailed committees, of the innumerable problems, such as mobilization, technical and military training, observation, including observation of artillery fire, workshops, stores, meteorology, wireless telegraphy, photography, bomb-dropping, and organization of all kinds, which are essential to the building up of an air service for military purposes on a firm and efficient basis.

Although seventy machines were available, it was obvious that flying and the carrying out of tests with aircraft was only one phase of the instruction carried out, as will be seen from the brief notes of the work accomplished, and it will be readily understood that the results of tests could not in many cases be made public, for reasons of military expediency.

During the first week the weather was anything but favorable and very disappointing, considering the time of year. Heavy rain and hail swept over the Wiltshire Downs, followed by slight frost, and a bitter northeast wind of 30 miles an hour, and gusty at that. A scheme of maneuvers was set by the Camp Commandant for the first day, which was primarily intended to test the value of reconnaissance from aircraft of troops stationary on the battlefield. The hostile troops were represented by the individual transport motorcyclists and men of the Royal Flying Corps, who were dispatched early in the morning with confidential instructions to take up positions and remain stationary, principally at cross-roads, within the area covered by the operations, and keep time till 1 P. M.; these positions were, of course, kept secret from the reconnoitering officers who were sent off later in the day and allowed one and one half hours in which to observe and make notes, on the understanding that they were to keep their machines at an altitude of not less than 2,500 feet. Each aeroplane carried a pilot and observer, and the latter was provided with a map of the theater of operations, and had to make his notes in the air and hand in his report immediately on return to camp. The results were not published, but are understood to have been satisfactory, and the pilots managed their machines exceptionally well in face of the very gusty wind. During this week the demonstrations of rigging and tuning up of aeroplanes which took place from time to time, for the special benefit of the rank and file of the Royal Flying Corps, were found to be very instructive from a practical point of view.

Observation of artillery practice was carried on during the second week, together with other work of an experimental nature, of which the results were not made public; speed tests, climbing and landing tests were carried out, the latter including flying by night and landing by the light of special flares.

It is recognized that since a military aviator may frequently have to land in an unknown part of a foreign country and get away again, and even during maneuvers in his own country can never be certain where he may have to come down, the power of landing with safety is one of the most important parts of his training, and is studied accordingly, both as regards choosing at a rapid glance around the best available landing place, and making the best landing practicable under unfavorable circumstances.

On June 30th the aircraft exercises consisted of aeroplanes searching for a disabled aircraft, represented by a balloon, which ascended from a point unknown to the searchers, some thirty miles from the Concentration Camp. The altitude of the balloon varied from 2,000 to 5,000 feet, and as the day was hazy, it could only be seen from a distance of eight miles at the farthest; nevertheless it was found by 50 per cent of the aerial scouts who were sent up in the aeroplanes to look for it.

Throughout the whole period of the month in camp the reconnaissance tests and practice were continuous and progressive, as was only natural, seeing that observation of the enemy's movements and dispositions is the end and aim to which all else connected with military aviation is subsidiary, and there can be no doubt that the combined training of all ranks and the opportunities for conference, exchange of ideas and mutual instruction, in addition to listening to lectures and discussions on various topics, were of the utmost advantage to all who took part in this first Concentration Camp for Aircraft in Great Britain.

The Canadian Arctic Expedition

ACCORDING to information received in Toronto September 1st, Stefánsson, the leader of the Canadian Arctic Expedition, set out from Martin Point, northern Alaska, on March 22nd, last for a sledge journey northward over the sea ice. After sending back a supporting party at the edge of the continental shelf, in latitude 70 degrees 20 minutes, longitude 140 degrees 30 minutes west, the leader proceeded with two men, one sled, six dogs, two rifles, and plenty of ammunition. He expected to turn back at the end of fifteen days, but thought he might be driven by winds and currents to Banks Land. Nothing, however, has since been heard of him, though two vessels have cruised along the coast of Banks Land in search of him. The southern section of the expedition, under Dr. Anderson, left Herschel Island about August 17th for Coronation Gulf, where explorations will be carried on in accordance with the original programme. A dispatch from Nome, dated September 1st, announced that the revenue cutter "Bear" had failed in its attempt to reach Wrangel Island, where Stefánsson's northern party took refuge last season after the loss of the "Karluk." The "Bear" was within 20 miles of the island on August 21st, but after fighting ice and storms for six days was forced to return to Nome for coal and provisions. She is now engaged in another attempt. The former revenue cutter "Corwin" has been fitted out by miners at Nome and has sailed on a similar errand of relief. Meanwhile the hope is still cherished that the Russian icebreakers "Taimyr" and "Vaigatch," which are making their third annual cruise in the Arctic, may succeed in bringing off the marooned explorers.

German Men of Science and the British Association

AMONG the party which proceeded to Australia to attend the meeting of the British Association were a number of distinguished German men of science, who, in most cases were accompanied by their wives, daughters, or sons. Germany's war with Great Britain has necessarily placed these scientists in a position of difficulty, since they are subject to the orders of the Commonwealth military authorities, as regards departure from Australia, and even in that event, their destination must be a matter for official cognizance and settlement. Perhaps the most popularly known men are Dr. A. Penck, professor of geography in the University of Berlin; Dr. F. von Luschan, professor of anthropology in the same university; and Dr. J. Walther, professor of geology and palæontology in the University of Halle. Included also among the visitors were a number of American, Russian, and Danish scientists.

It is possible that the temporary hospitality of America, a non-belligerent power, may prove a way out of the grave situation that has arisen, one unique in the annals of science, and of unforgettable character.

For the information of our readers we append a list of American scientists who accepted the invitation of the British Association to its Australian meeting:

Mr. C. G. Abbot, director Smithsonian Astrophysics Observatory, Washington.

Mr. Z. Baber, professor of geography and geology, University of Chicago.

Mr. F. Baker, Scripps Institution for Biological Research, San Diego, Cal.

Dr. Lyman J. Briggs, Department of Agriculture, Washington.

Dr. R. T. Chamberlin, Geological Department, University of Chicago.

Dr. E. G. Conklin, professor of zoology, University of Princeton.

Dr. C. B. Davenport, director Department of Experimental Evolution, Cold Spring Harbor, Long Island.

Prof. W. M. Davis, Harvard University.

Dr. G. A. Dorsey, curator of anthropology, Field Museum of Natural History, Chicago.

Mr. C. F. McClure, Department of Comparative Anatomy, Princeton University.

Mr. E. S. Moore, professor of geology and mineralogy, School of Mines, Pennsylvania State College.

Prof. Ira Remsen, Johns Hopkins University, Baltimore.

Dr. H. C. White, professor of chemistry, University of Georgia.

Dr. W. M. Wheeler, professor of economic entomology, Harvard University.

War Issue Number 2 of the Scientific American

THE September 5th issue of the SCIENTIFIC AMERICAN—our War Number—has met with the success that we anticipated. Carefully prepared with the assistance of military men, each an expert in his special field, it met a popular demand for accurate information on the technical aspects of modern warfare, which seems to be insatiable. Large as the number was and packed with articles and pictures of the most timely character, it could not possibly exhaust the subject. Accordingly, it has been decided to make the next monthly magazine number of the SCIENTIFIC AMERICAN—that which will bear the date October 3rd—another war issue, in which subjects will be discussed fully as important as those which were taken up in the September number, but which the limitations of space prevented our considering at all.

We have heard very much, for example, of the turret fort, which was used with such brilliant success at Liege, but which finally succumbed to the enormous siege artillery which the Germans eventually brought to bear. Here we have at once two subjects on which practically nothing has appeared: The modern fixed fortification of steel and concrete, and the means for reducing it. The October 3rd issue of the SCIENTIFIC AMERICAN will, therefore, contain an elaborate drawing and description of the famous Gruson turret, with photographs showing exactly what was the effect of the German siege artillery upon it; and also an article on those marvelous 11-inch siege guns which, by high angle fire, dropped hundreds of pounds of high explosive upon hapless defenders crouching behind their protection and manfully serving their guns to the last.

We have heard much, too, of the floating mines with which the Germans have sown the North Sea, and which have proved such a menace to neutral shipping. How are these mines constructed? What is their effect? How does a battleship guard itself against them? These questions will all be taken up in an authoritative way.

The submarine boat, too, will command its share of attention. Sectional views of boats will be published and the interior mechanism of a submarine revealed just as if it were a watch that has been picked apart.

Of fortifications in the field much also may be learned from the October 3rd issue of the SCIENTIFIC AMERICAN. It is known in a general way to the public that obstacles of every kind are thrown in the way of attacking infantry—barbed wire, felled trees with all their branches and similar barricades. Such obstacles and defenses are thrown up very systematically. The character of the obstacles and the methods of placing them in position will be described and illustrated.

John Barrett, director of the Pan-American Union, was the first to draw the attention of American manufacturers to the trade opportunity which confronts them as a result of the war. The SCIENTIFIC AMERICAN has asked him to prepare an article in which the prospects that now tempt the American business man are carefully considered. Letters from prominent financiers, merchants, and manufacturers on the subject will also appear.

A Street Traffic Signal

TO ease the work of the traffic policeman and afford a far greater measure of protection to the traveling public, Mr. H. D. Heuer of St. Louis, Mo., has invented a device by means of which the guardians of the traffic will not only be protected from the weather, but will be relieved of the strain of extending their arms and removed from the direct center of traffic. Mr. Heuer offers to give his invention to the public. The device is exceedingly simple in construction, and by no means expensive. It consists of an overhead signal or semaphore, operated by a traffic officer who is removed from the direct path of traffic and stationed in or under a shelter house, which is slightly elevated, on the street corner, where he can observe and direct the movements of traffic by operating the signal device and signal bells. He is consequently out of the danger zone himself, and can devote all his thought and energy to minimizing the risk of others. The signal will be suspended from a cable attached to poles located on diagonal corners, and in plain view of pedestrians and vehicle drivers for a long distance.

The signal consists of four semaphore blades, each about 36 inches long, constructed similarly to an electric ceiling fan, two of the blades being colored red, signifying "danger" or "stop," while the other two will be colored white, and will signify "clear" or "go ahead." To render the signals effective by night, electric lamps will be provided for the semaphores, the colors being in accord with the colors of the semaphore blades. The signal is moved 90 degrees in both directions, the attention of the public being called to the change by an electric bell, which is situated on the pole where the traffic guardian is standing.

When the signal is not in use as a guide to traffic, the semaphores may be placed diagonally, which would be an indication that the traffic guardian is absent and traffic could proceed under its own control.

The Current Supplement

IN the current issue of the SCIENTIFIC AMERICAN SUPPLEMENT, No. 2020, of September 19th, will be found a splendidly illustrated article on the Canadian Alps, which introduces a new American playground and scientific storehouse that will be appreciated by all lovers of natural scenery. There is a second installment of Prof. Bateson's remarkable address on Heredity, which is being published in full, and every line of which will be read with interest by laymen as well as scientists. A New Application of Roentgen Rays tells about an infallible method of establishing the authenticity of oil paintings, and the detection of forgeries in art. America's Opportunity by a World Catastrophe is an interesting *resumé* of history, and discusses a matter that is engaging the attention of the whole country. The Industries of Liege tells of its great manufactories and many timely facts about the modern artillery produced there and in other European countries. The conditions governing the coming contest for tractor biplanes at San Diego, by the U. S. Army officials, contains matter of value to all connected with the building of aeroplanes. There is also much other valuable matter.

Correspondence

[The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]

The Force It Takes to Stop a Motor Car

To the Editor of the SCIENTIFIC AMERICAN:

In the issue of July 4th this year there was an inquiry with reference to the force required to stop a motor car, and you announced that you would be glad to hear from your readers on the problem. I have seen no response in the later issues and would submit the following as an approximate solution of the problem.

The specific inquiry was—what will it take in weight or power to stop an automobile weighing 3,500 pounds, traveling 20 miles an hour, within 30 feet.

One and one half times the number of miles an hour is a very close approximation to the number of feet per second, and we may, therefore, take the velocity of the car as 30 feet per second.

The energy of the assumed car in foot-pounds is, therefore, approximately $3{,}500 \times 30 \times 30 \div 64.4$

$$E = \frac{Wv^2}{2g}$$

or 48,913 foot-pounds.

As the car is to be stopped in 30 feet, the force in pounds required to be exerted throughout the stop is $48{,}913 \div 30 = 1{,}630$, which is nearly one half of the weight of the car.

From the equation $h = \frac{v^2}{2g}$ for a falling body, we should also find that the height through which the car would fall in acquiring the velocity of 30 feet per second, is about 14 feet, and as this is a little less than one half the distance in which the car is assumed to be stopped, it will require a force of a little less than one half of the weight of the car $\left(\frac{14}{30}\right)$ acting through the space of 30 feet to absorb the energy of the car and bring it to rest. $\left(\frac{14}{30}\right) \times 3{,}500 = 1{,}638$, which confirms the previous computation.

The time required to bring the car to rest is equal to the distance, divided by one half of the velocity at the moment when the stopping force begins to act, in this case $30 \div \frac{1}{2} \times 30 = 2$.

The work, 48,913 foot-pounds, is, therefore, performed in two seconds, or at the rate of 24,456 foot-pounds per second, and as a horse-power performs 550 foot-pounds of work per second there would be an exertion $24{,}456 \div 550 = 44\frac{1}{2}$ horse-power in bringing the car to rest.

Conversely 44½ horse-power would generate a velocity of 20 miles per hour in a space of 30 feet, if nothing but the inertia of the car were taken into account.

As a practical matter there would also be the road friction, running gear friction, air resistance and the like to be overcome, so that much more than 45 horse-power would be required to accelerate the car to that speed within that distance, if it were possible to be done.

For a like reason somewhat less than the force or power computed as above would be required as a braking force to stop the car, for the road friction and air resistance would assist, and the running gear friction acts in effect as a brake, in so far as it opposes the free rotation of the wheels.

It is much more important to know the minimum distance in which a car can be brought to a stop from a given speed, than to know the force required or power consumed. There is no difficulty in making brakes to give the maximum retardation attainable by braking action.

The limit to the retarding effect, and to the reduction of distance within which the stop can be made, depends upon the frictional or tractional hold of the wheels on the road surface, and this varies greatly with the condition of the road, being very small on a wet and muddy or "greasy" surface.

Without having any definite information, I judge that the coefficient of friction between a good gravel or macadam road and the usual pneumatic tire without chains is about 0.4, and that it is rarely more, and frequently much less than that in ordinary driving conditions.

If we take the coefficient of friction of tire on road as 0.4 we have only four tenths of one half of the weight of the car as the maximum retarding resistance derivable from the brakes, when, as is usually the case, the brakes are on the driving pair of wheels only, and the weight of the car is about equally divided between the front and rear wheels.

We have computed that it takes a force of about one half the weight of the car to stop the car within 30 feet, from a speed of 20 miles per hour. We have, however, less than a quarter of the weight of the car available as a retarding force, and consequently from 60 to 65 feet is the shortest distance in which a car can be stopped from that speed by the brakes on a level road with an excellently holding road surface.

The distance, it will be seen, does not depend upon the weight of the car, except for wind and road friction resistances and the like, which are not very large factors in coming down from 20 miles per hour. A three-ton car can be stopped by its brakes in about as short a distance as a motor cycle, although it would take a much larger number of telegraph poles to bring the car up short than it would to stop the motor cycle.

Drivers should also remember that the distance in which a car can be stopped by the brakes increases as the square of the speed. It is four times as great from a speed of 40 miles per hour as from 20 miles per hour, and 9 times as great from a speed of 60 miles per hour. About 250 feet is the least distance in which a car can be stopped from 40 miles per hour, and over 500 feet from 60 miles per hour. The wind resistance gives quite an appreciable aid, however, at the higher speeds.

In stopping from 20 miles per hour the car will travel 45 feet before its speed is reduced to 10 miles per hour, and 15 feet further in coming to a full stop from the 10-mile speed.

Except with an excellent road surface the distances will be much greater, and possibly by the use of chains they might be reduced a little, but if a driver is willing to subject his car and tires to the strain I think he will find by actual test that the distances above given are the best he can make.

Of course if all four wheels were equipped with brakes the distances would be about one half of those above indicated.

There are various other factors that might be discussed if space were available.

A general formula for the least distance in which a car can be stopped by its brakes (on rear wheels only) is:

$$D = \frac{v^2}{gf}$$

where

D is the distance in feet.
v is the velocity in feet per second.
g is the acceleration of gravity in feet per second.
f is the coefficient of friction of tire on road.

It will afford a reasonably safe margin to take f as 0.3 (30 per cent), and a good working approximation is afforded by dividing the square of the velocity by 10 to give the distance in which the car can be stopped on a good road surface in good condition, i. e.,

$$D = 1/10\, v^2;$$

or, divide the square of the speed in miles per hour by 4.4, or say by 5, to give an easily computed result with a reasonable margin of safety. This would give 80 feet as the distance when the speed is 20 miles per hour.

Boston, Mass. JOSEPH P. LIVERMORE.

The War of the Nations

To the Editor of the SCIENTIFIC AMERICAN:

Without entering into the partisanships or race animosities of Europe, without taking sides in what is their affair, and not ours, on a basis of our natural sympathies, does it not still behoove us to consider what effect the result of this great conflict may have on our own interests and destinies as a nation? For that such an effect it will have is undeniable.

Should the allies win, the *status quo ante bellum* will be largely resumed so far as the world outside of Europe is concerned except for the annihilation of German commerce. It is true England will no longer be menaced by Germany, therefore will be more strongly confirmed in her naval superiority; but, on the other hand, England will still have enough to take care of with the other nations without resuming her quondam position of bully against this nation.

Should, on the other hand, the allies be defeated, Germany would become supreme on the seas and assume the Napoleonic rôle of France a century ago, Assuming this position can be maintained, the German navy and mercantile marine would dominate the world. Which, then, is most to our interest as a nation?

The prime, if not only, fact to remember in deciding this question is that whereas England has always supported our Monroe Doctrine, Germany has always been hostile to it; in fact, we may say that but for England we never could have supported it until now. Germany is, among the nations, a "bounder" or "climber," as the English aptly term one who eagerly elbows his way to the front without regard to the rights or interests of others. With her rapidly growing power she has asserted her voice more and more loudly in "Weltpolitik," and without considering her eager competition in the South American trade as being other than an amicable one, we cannot properly neglect to note her assertiveness in matters closely touching our own sphere of interest, notably in the Mexican and San Domingan muddles. It is well understood that Germany covets naval stations or other territorial outposts in the West Indies, and it cannot be a bad guess that she would follow the same tactics to get them as she did, for example, in the case of Kiao Chao, or Austria in the case of Bosnia, or both of them in the present war. The Teutonic policy of territorial forward movement has always been one of sudden seizures, taking would-be opponents by surprise and then pleading *fait accompli*.

With Germany in the ascendant, it goes without saying that we should have to greatly strengthen our naval power and to maintain the utmost vigilance to prevent some such surprise against us somewhere in the new world, with the almost certainty of becoming ultimately embroiled ourselves in a war with Germany that would reduce us, as it previously reduced the other nations, to a secondary place.

To these considerations is to be added that of similarity of national ideal as between Germany and the allies. Germany puts forward as her great slogan the repression of the slavic "barbarians"; but the facts of history are not to be forgotten. Without even mentioning the century-long friendliness of Russia for the United States, unbroken by any unfriendly act, let us go back again to the sequel of the Napoleonic wars when the so-called Holy Alliance was formed by Russia, Prussia and Austria with the object of upholding absolutism in general and preventing the revolt of the Spanish colonies in America in particular. It was this very Holy Alliance, led by the three European autocrats, but opposed, be it remembered, both by Great Britain and France, that led to the establishment of our historic Monroe Doctrine. Names and circumstances have changed, but national character has not. Western Europe and the United States still remain the free countries of the world, and eastern Europe holds the absolutist countries; the dividing line between them is clear, and so is the interest of the United States.

The effort of one country or one race to dominate all the others must ultimately come to naught; such has ever been the history of the world, and all such empires but one have been of brief duration, the single exception being due to the enormous concentration of civilization at a single point. Ultimately such an empire as that of Napoleon expands until it falls to pieces of its own weight, but in the meantime such a military predominance as that threatened by the Teutonic civilization at this time, even for a few years, would work serious and possibly irreparable injury to our interests.

Milwaukee, Wis. GEORGE W. COLLES.

An Opinion of Our War Number

To the Editor of the SCIENTIFIC AMERICAN:

I wrote you on yesterday that the SCIENTIFIC AMERICAN for September 5th had not been received. I beg to inform you that it came this morning. I am sorry to have troubled you, and trust this will reach you before you have sent us another copy.

Permit me to say this paper contains far the most complete and comprehensive information in regard to the war that I have seen anywhere.

I am buying an extra copy for my personal pleasure.

My husband, the late William Ogilvie, ex-Governor of the Yukon Territory, was for many years a constant reader of the SCIENTIFIC AMERICAN, and one of your very strong friends. I feel you may be pleased to know this. (MRS.) O. P. R. OGILVIE,

Ottawa, Canada. Librarian, Mines Branch.

For Passing Through Mine Fields

To the Editor of the SCIENTIFIC AMERICAN:

In these days of loose floating mines would not a rope net device projected off both sides of the bow of a slow-moving ship (after the manner of the familiar cow-catcher on a locomotive) tend to lessen the danger of destruction by such mines? It seems to me the slow speed of vessel (which is presumed under such conditions) would deflect a mine in many cases and at least prevent a percentage, even though small, of losses at the present time.

I have been told by friends that this is an impractical suggestion and altogether not feasible. Will you kindly give me your opinion on the subject?

New York. CHARLES P. FRY.

[The idea is not altogether impracticable. If the net were of wire and capable of being lowered on booms from the bows, it would form an effective mine-exploder, when a ship was passing, at slow speed through a mine field.—ED.]

Artificial Rubber from Coke Oven Gases

AT a recent meeting of the Iron and Steel Institute in London, its president made this significant statement: "It is being sought to obtain from coke oven gases those hydrocarbons the derivatives of which are found in rubber. Experiments that have been made permit the foreshadowing of the manufacture of artificial rubber from this source."

An Automobile Radio-Telegraph Station for War Use

Wireless Car for the French Army Equipped with Powerful Field Apparatus

By Jacques Boyer

THE new automobile wireless station of the Compagnie Générale Radiotelegraphique is the most powerful field station of this sort that has yet been constructed. The vehicle, which carries its own crew and supplies, can travel 250 miles without reprovisioning, and can then send wireless messages continuously for five hours. The first communications, made for the purpose of adjusting the instruments, were recently exchanged between Chateauroux and Paris, a distance of 186 miles, with complete success. The constructors of the portable station hope soon to increase this range by making some changes in detail, but the results already obtained are sufficiently remarkable to invite attention.

The chassis of the car, made of hammered steel plates and solidly braced, is of the 16 horse-power commercial Renault type, approved by the Minister of War. It can carry a load of 5,500 pounds. The hooded four-cylinder motor corresponds to the following specifications: interior diameter of cylinders, 3.5 inches; stroke, 5.5 inches; valves controlled by a single arbor with cams; ignition by high voltage magneto, automatic carbureter with braked air valve, capable of using gasoline, benzol, or carbureted alcohol.

The speed changer, which gives four speeds forward and one backward, carries a pinion and gearing for driving the alternator in the interior of the car. The pinion is engaged and disengaged by moving a hand lever. The control of the speed changer is also effected by means of a hand lever, without lateral displacement, and the motion is transmitted to the wheels by a shaft provided with a universal joint.

There are two systems of brakes. One brake, operated by a pedal, is applied to the transmission shaft, immediately behind the speed changer. Another pair of brakes, controlled by a hand lever, is applied to the rear wheels.

The irreversible steering gear, comprising an endless screw and a helicoidal sector, controls the levers of the fusees by the intermediation of a damping tube. The wheels, made of wood, with hubs of the artillery type, have solid rubber tires, single for the front and double for the rear wheels. The chassis measures 18.6 feet in length and 6 feet in width.

The body of the car is designed to afford the maximum of comfort to the thirteen operators that can be carried with their equipment. In order to prevent the sound of the wireless apparatus from escaping and betraying the presence of a wireless station, the cabin is inclosed in double walls with an interlining of felt. The alternator is placed in a closed, but demountable, compartment in front, beside the driver's seat, behind which are the wireless telegraph instruments, a table and several upholstered benches, sufficiently long and wide to be used as couches.

The mast is made in interchangeable segments, which are carried on the roof of the car. It is erected in the field by three men, in the following manner: The segments are assembled on the ground, like those of a fishing rod, and the mast is then raised by means of a pole and a tackle. In this operation the mast turns on a broad plate which serves as its base.

The antenna is composed of six cables of hard bronze wire, which are attached to the insulator at the mast-head and are stretched laterally by cords attached to pegs driven in the ground. Insulators of reinforced ebonite are interposed between the cables and the cords. The mast-head is connected with the car by a seventh wire. The earth connection is made by six strips of wire netting, about fifty feet long and twenty inches wide, which are laid radially on the ground around the station.

The current required for the operation of the wireless apparatus is furnished by a self-exciting monophase alternator of very light construction. The alternator is driven by the motor of the car, with which it can be connected by moving a lever attachment to the speed changer.

The rheostat of the exciter is mounted on an insulated base within easy reach of the operator.

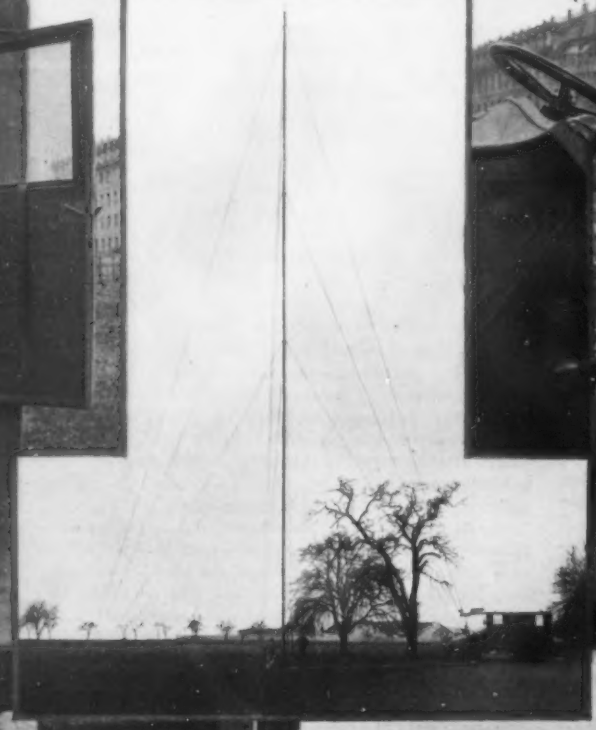
A static transformer of the commercial type, immersed in oil, raises the voltage from 250 to 4,000. The transformer is carefully insulated and is protected from return currents of high frequency by two choking coils, without iron cores.

The apparatus also includes a thermic voltmeter, with its commutator, a thermic amperemeter, a quick-acting

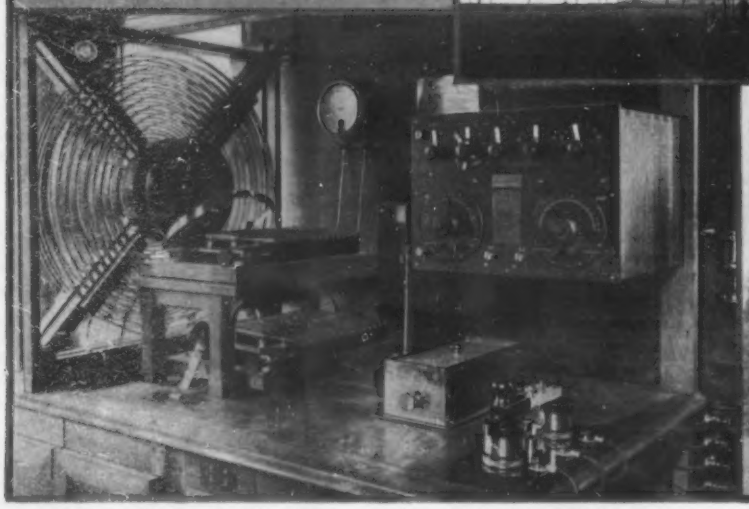
(Concluded on page 238.)

The operator at work in the portable station.

The automobile wireless station with its mast raised to full height.



The alternator beside the driver's seat.



General view of the radio transmitting and receiving station.

The automobile partly broken away, to show the radio-telegraph apparatus.

Left—The third baseman has missed a wild throw from the field, and although the ball has passed him ten feet, he has not yet commenced to recover his position. This illustrates the speed of a thrown ball. Right—Catching a runner napping at first. The slide by the runner gained the time required by the fielder to stoop and touch him. Center—Two out and three on bases, and what he did. The ball is half way to the base, but the catcher's hands are not yet down.

Time as a Factor in Baseball

What Must be Done in a Fraction of a Second

By C. H. Claudy

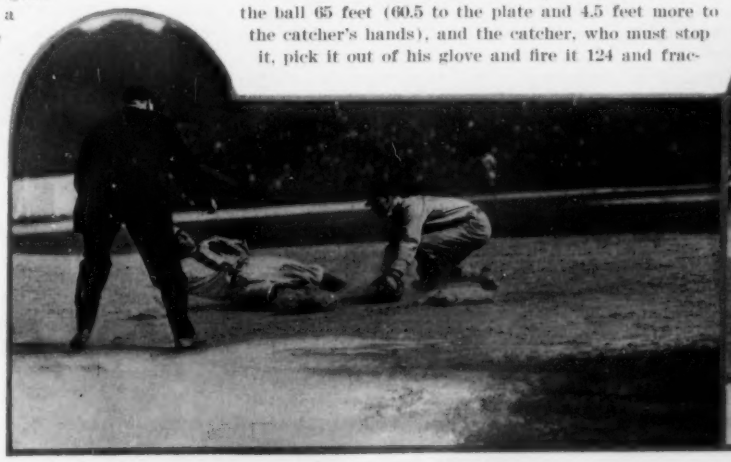
THE fathers of baseball builded better than they knew when they laid out the first diamond and decided upon the weight and size of balls and bats. The popularity of the game as a spectacle depends largely upon its uncertainty, and its uncertainty depends entirely upon the relation between the distances between bags and the plate, the distance a ball can be batted and thrown, and the time required to make the ball travel, whether propelled by arm or bat.

As every "fan" knows, the bases are 90 feet apart. The fastest time ever made about the bases from home to home was 13½ seconds, and this not during a game. Fifteen seconds about the bases is fast time, or 3¾ seconds between bases with a running start for all except first base. First base has been made from the plate on a bunt and run in 3½ seconds, but the time is very unusual, 4 seconds flat being good time. Ask a "fan" how fast a ball batted so it strikes the ground in the infield before it is fielded goes on the average. He will guess anywhere from 30 to 300 miles an hour! But hold a stopwatch on all batted balls during a game and count only those which are infield grounders, and you will find that they average about the speed of a fast express train—say 66 miles an hour, or 88 feet per second.

The shortstop will play from 110 to 135 feet from the plate. Suppose he gets an infield grounder 125 feet from the plate. At 88 feet a second, it has taken 1.4 seconds to reach him. Allowing 1.7 seconds for the throw to first base, he has 0.9 of a second only in which to make the catch, draw his arm back, and make his throw. Yet more men are thrown out at first base on ground balls fielded by the shortstop than ever beat the throw to the first station! The play is almost always close—so close that one of the differences between a good and a poor first baseman is that the good one will reach far forward to get a ball, knowing that the time it takes the ball to travel the 5 feet he can reach may make the difference between "safe" and "out!"

It is because of this delicate balance between time of batted ball and throw, and the ability of a man to run 90 feet, that the baseball authorities are so rigid in their requirements of the structure, size and weight of a baseball, and why major league players can play with none but major league balls made by one of two great firms. They know, these baseball Solons, that a fraction of an ounce difference in weight, a fraction of an inch difference in size, may weigh down the balance in favor either of the fielder or the batter—and the balance (and so the uncertainty) must be kept as perfect as possible.

When a man gets on first base, his next thought is of second—the station only 90 feet away, which looks so near and is so far. A good base runner *may* be able to take a "lead" of 10 feet—though he must needs be very good indeed to do so with a clever pitcher. He may thus reduce the distance between bases to 80 feet. With a standing start, any good base runner should make this distance in 3 seconds. Starting as the pitcher begins to deliver the ball, it would seem easy enough to slide into that bag in 3 seconds time, well ahead of the ball. Yet the pitcher, who throws the ball 65 feet (60.5 to the plate and 4.5 feet more to the catcher's hands), and the catcher, who must stop it, pick it out of his glove and fire it 124 and fraction feet to second base, manage between them to handle the ball so quickly that in the majority of cases the ball is waiting for the runner when he arrives, giving the shortstop or second baseman who caught it plenty of time to reach forward and down and touch the runner with the hand which holds the ball. If a total of 3 seconds be allowed for the two throws, and 0.3 of a second be allowed the catcher to catch, set himself and throw, then the ball travels 184.5 feet in 2.7 seconds, or at the rate of 69 feet a second. This rate must be again divided, since the pitcher's pitch is much more rapid than the catcher's throw. From 100 to 120 feet per second is average speed for a fast ball such as is thrown by Walter Johnson or Joe Wood. The catcher can get no such speed on his throw, since he must throw along a curved trajectory, which at its greatest height is 8 or 9 feet in the air. Part of his throwing force is put into making the ball climb. Fans who do not know the game sometimes speak of a catcher as throwing "weak" because his throw fades down to the ground at second base. As a matter of fact, the good catcher expects to have his ball reach second base a trifle to his right of the bag and low down. He hopes for this because the minute fraction of time between the fielder's catch at the ball and his dropping his hands to "get" the runner may make the difference between "safe" and "out." For the same reason the base runner slides. He doesn't make quite as fast time sliding as he would running. But he is under the necessity of stopping quickly and "on the bag," and of keeping his anatomy as far away from the fielder as he can. Sliding makes him certain of a quick and sudden stop, and also makes it necessary for the fielder to drop his hands (which takes time) to touch him. Hence the catcher saves this extra fraction of time with a low throw.



Blocked off at second base.

Fungo hitting.

Ask the bleacherite which can be hit the farther, a fast pitch or a slow one, and he will correctly tell you the former. But he won't know why. Were a baseball pitcher infinitely powerful and were he to throw a hundred balls, each time a little faster than the previous time, there would come an instant when the force of the ball forward would be equal to that inherent in the shoulders and bat of the batter—the bat would break, and the ball fall "dead."

But the modern pitcher, powerful though he is, is far from that point. The force he puts in his pitch must, physically speaking, be added to the force in the batter's swing. The resultant of the two is the force in the batted ball. If the pitcher pitched with all his force at a stone wall, the ball would rebound. The harder he pitched, the greater the rebound. It is because the rebound is greater from the bat when the stick meets a fast pitch than when it meets a slow one, that the longest hits are made from fast pitching. Of course, fast pitching is hard to hit, because that element of "time" enters again—the batter, expecting one sort of pitched ball, has too small a fraction of a second after recognizing the pitched ball as a "fast one" to change his mind or "unset" his muscles. Hence

(Concluded on page 238.)

The Micro-structure of Steel

By J. F. Springer

THAT somehow carbon enters into the composition of steel is no new fact. The method of manufacture and chemical analysis each testifies to this. But neither gives any adequate information as to just how the carbon is distributed. Thus chemistry may tell us that a certain sample of steel contains 0.80 per cent carbon. Does this mean that every piece of the steel however small will contain carbon in the same percentage? This is a question which the chemist seems unable to answer. But the microscope furnishes the required information, and gives a negative answer.

Consider what this means. It means, first of all, that steel is *not* a chemical compound. Water is such a compound; and wherever you have a quantity of pure water—be it large or be it minute—there you have hydrogen and oxygen in the ratio of 1:8. In the second place, it *may* mean that some portions of the steel may not contain carbon at all. And, in fact, steel is not only not a chemical compound, but it does consist of particles some of which contain carbon and some of which do not.

Apparently wherever the carbon occurs, it is in chemical combination. That is to say, steel does not contain particles of carbon. It contains molecules of carbon in combination with molecules of iron, the two forming iron carbide, Fe_3C. Indeed, some think there may be more than one carbide. But the great fact is to be emphasized—carbon does not occur as free carbon.

On the other hand, the iron does occur by itself as well as in chemical combination with the carbon. A special name has been given to the pure iron. Metallurgists speak of it as *ferrite*. The iron carbide (Fe_3C) has also received a special name, *cementite*.

Now there is another important fact, which is true of steel as of other metals. When steel solidifies it crystallizes. If it be permitted to cool without undue haste or unsuitable manipulation, the crystals will be found to be quite large—so large indeed that when the lowest powers of the microscope are used, it is scarcely possible to get an entire grain within the field. Upon examination of such a grain or part of a grain, it will be found, if the surface has been properly prepared, that long stripes appear—which may be more or less curved but which are incredibly thin, so thin, in fact, that upward of 25,000 would be required to cover an inch. Now each of these stripes is known to consist of two layers—one of ferrite, and one of cementite. The structure or complex thus formed, consisting of these two substances intermingled in the way described, or sometimes as granules of cementite in a matrix of ferrite, is called *pearlite*. This name has been given to it because of the iridescence of the lamellar variety reminding the observer of mother-of-pearl.

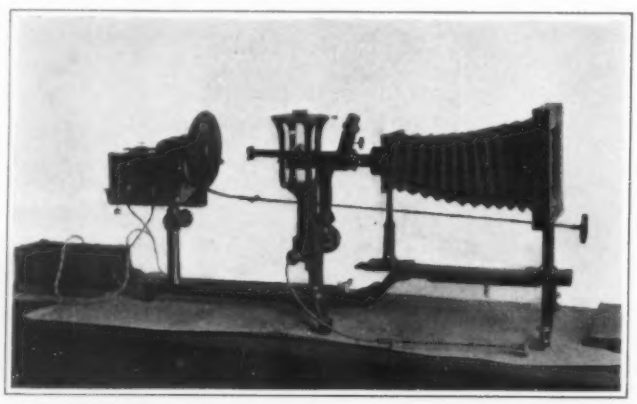
Sometimes the steel will consist entirely of pearlite. This is, according to some, when the carbon content is just about 0.90 per cent, and when it has not been suddenly cooled from a high temperature, as by plunging into cold water. However, if a less amount of carbon or a greater amount be present, there will be an excess in the one case of ferrite and in the other of cementite. With a certain percentage of carbon, the ferrite and the cementite will be so balanced as to produce just pearlite. But if the carbon falls below this percentage, there will be too much ferrite. The excess will be found in "veins" or envelopes around and between the grains of pearlite. If on the other hand there is too much carbon, an excess of cementite will be formed which will occur in veins around and between the grains of pearlite. If we examine two photographs, the one showing an excess of ferrite and the other an excess of cementite, they may appear very similar.

It will interest some to know that experiments have been made to determine the hardness of ferrite, cementite and pearlite. The ferrite has been found to be comparatively soft. If we take it as a basis of comparison, it has been ascertained from averaging a large number of tests that pearlite is about 4 times as hard. Cementite has been determined to be about 272 times as hard as ferrite. It might, at first sight, seem incredible that with one of its constituents so excessively hard, pearlite should be as soft as it is. But this result is due, no doubt, to the fact that in pearlite the hard cementite is interstratified with the soft ferrite.

There are other constituents of steel—of the hardened varieties—but none is so hard as cementite, according to the elaborate tests which have been made by H. C. Boynton. Mild steels contain, then, as hard a constituent as any steel. They are soft because the cementite does not occur in large amount and because of the manner in which it is intermingled with the ferrite.

It is a simple matter to determine the amount of cementite in a sample of carbon steel whose chemical composition is known. For *all* the carbon is taken up in this form (as scientific knowledge stands to-day). Taking account of its formula—Fe_3C—and remembering that the atomic weights of iron and carbon are, respectively, 56 and 12, we calculate at once that the carbon is combined with 14 times $(56 \times 3 + 12)$ its weight of iron. So that, whatever the carbon percentage may be, 15 times that percentage represents the cementite percentage $(14 + 1 = 15)$. Thus, if the steel has a carbon content of 0.40 per cent, the cementite will constitute but 6 per cent of the whole, by weight. Of course, it may occupy more than 6 per cent of the volume.

Suppose now that the steel has a carbon content of just 0.90 per cent. It will then, as has already been observed, consist of pearlite alone. If we calculate the cementite present by multiplying the carbon percentage by 15, we shall get 13.5. This means that pearlite consists of 13.5 per cent cementite and 86.5 per cent ferrite. As before, these percentages refer to weight and not to volume. Probably the cementite has a lower specific gravity. But, even so, the presence of nearly 6½ times the weight of soft ferrite would seem to go far toward explaining the softness of pearlite. Now the thickness of a strip of cementite plus the thickness of a strip of ferrite in lamellar pearlite may be taken as about 1/25,000 inch. Assuming that the specific gravity of cementite is ¾ that of the ferrite, we conclude that it occupies 4/3 of the space, weight for weight. Instead then of the volumetric ratio being 1:6.4 (13.5 per cent : 86.5 per cent), it will be 1.3:6.4. That is, the cementite occupies roughly 1/5 the space taken up by the ferrite—or, what is the same thing, 1/6 of the volume of the pearlite. The little strip of cementite, then, which occurs in lamellar pearlite may be estimated as having the incredibly small thickness of 1/6 of 1/25,000. This gives 0.0000067 of an inch. It must be remembered that this result cannot be regarded as anything more than an estimate, since the relative specific gravities are only roughly guessed at and the width of the combined stripe is hardly known with exactness. Now the instrumental means by which the constitution of unhardened steel may be microscopically observed and a record made is an interesting piece of apparatus. Accompanying this article is shown a photograph of an instrument of this character made by E. Leitz and in use at Columbia University.



Microscope and camera for use in making metallographic observations.

It will be noticed that there is a long bed frame from which four standards rise. The one on the left carries the means of illumination, together with a disk pierced at the center. The carbons of the arc light are in plain view, although the focus of the arc is hidden within the hood. It is possible to manage and adjust these carbons so as to maintain the arc itself at a definite point. Further, the arc may be brought up close to the disk or withdrawn from it. The two standards on the right carry the camera and are so mounted that the positions of the sensitive plate and of the outer end of the bellows may be adjusted independently. The remaining standard seen at the center of the view carries two distinct parts of the apparatus. One of these is the stand upon which the specimen to be examined is placed. This part may be moved vertically independently of the other part, consisting of a system of tubes. One of these tubes, projecting horizontally toward the left, is provided with a condensing lens by means of which the stream of light coming from the arc light through an iris-diaphragm arranged on the disk may be collected and condensed upon a prism. This prism is arranged within the box-like compartment vertically beneath the specimen seen on the stand. Just above this prism is a microscope. When the light from the arc reaches the prism, it is deflected upward through the microscope and onto the under surface of the specimen, which it thus illuminates, the stand being perforated for this purpose. The light is then reflected back through the microscope. As it leaves the microscope it falls upon a second prism somewhat to the right of the former one. By means of it the stream of light is brought again to the horizontal and sent through the horizontal tube seen to the right and into the camera. However, by means of a third prism carried by the tube projecting obliquely off from the right-hand horizontal piece, the stream of light may be intercepted and passed through a suitable ocular arranged on the outer end of the tube. This detail of the apparatus is controlled by a thumb-screw. The observer is thus furnished with a means of viewing the image that is to be formed on the sensitive plate. Indeed, it enables the operator to use the apparatus without reference to photography. It will be remembered that the stand is vertically adjustable independently of the tube system. The object of this is to enable the metallographer to vary the distance between the surface of the specimen and the object glass of the microscope. In the present instrument this variation of distance is admirably secured without disturbance of the course of the illuminating stream of light. In other words, the proper adjustments necessary to conduct the light properly from the generating arc to the sensitive plate may all be made without taking into account the power of magnification to be used. The wheel seen back of the central standard operates a rack and pinion for large movements of the stand. The finer ones are made by either one of two heads. One of these is in view and may be controlled by the flexible rod extending within reach of the operator when at the camera. The other rod, whose control is also within his reach, enables him to manage the arc.

It is by means of such apparatus as this that the new and vigorous science of metallography is making such notable contributions to our knowledge of the constitution of steel and other alloys.

The Dewey Decimal System for Filing Pamphlets, Clippings and Books

ABOUT thirty years ago, Mr. Melvil Dewey devised his well known system of decimal classification, now extensively used in American libraries, both public and private. The system has the immense advantage of being infinitely extensible, so that it is easily adapted to the needs of a growing library or collection of books. All knowledge is classified into ten main divisions; each division is subdivided again into ten parts; and each of these parts is likewise capable of subdivision into parts. Subdivision can be carried further to any desired degree. Whatever the merits of the Dewey system may be, its author was not sufficiently acquainted with science and engineering to prepare a satisfactory classification for them. In the earlier editions "Electrical Engineering" is made a subdivision of "Mechanical Engineering." In the latest edition there is no recognition of "Genetics," and "Eugenics" is classed under "Evolution" instead of "Biology." As a result of these defects, librarians of scientific and engineering societies have made special extensions of the Dewey system to suit their own purposes. Thus the Engineering Experiment Station of the University of Illinois has published an admirable extension which covers the entire field of mechanical and electrical engineering, an extension which has been partially incorporated by Mr. Dewey himself in the latest edition of his classification. The Iowa University School of Mines has made a very elaborate extension to cover mining engineering and geology. Among private libraries, that of the General Electric Company has published a very minute and useful subdivision of the Dewey system, which covers the entire field of electrical engineering. Unfortunately these and similar independent efforts to adapt the Dewey system to the requirements of specialists, do not agree with one another. There is no need for this disagreement. It should be simple enough for librarians of special collections to agree upon a classification which will be accepted by all those who realize the immense advantages of the Dewey decimal system. Eventually there will be one system of decimal classification, and the longer we wait to establish it, the more difficult it will be to conform to it when it becomes imperative.

An Antidote for Wasp Stings.—At this season of the year it not infrequently happens that persons biting unguardedly into fruit in which a wasp is concealed receive stings in the mouth or throat. Such stings may be exceedingly dangerous and even fatal, since the affected tissues swell rapidly and this is liable to cause difficulty in swallowing and breathing. An effective antidote is employed in Switzerland, according to *l'Illustration*. "The sting is rubbed vigorously with garlic, or, if it is too deep in the throat for this treatment, a few drops of the juice from bruised garlic are swallowed. If garlic is not to be obtained onion may take its place, but is a less active agent." The efficacy of this simple remedy was verified by a Swiss specialist, who found it important enough to be presented at a session of the Vaudois Society of Medicine.

The Smallest Public Service Plant in the Country

By George Frederic Stratton

THE smallest hydro-electric station in public service is in the gulch of a torrent which races down through the Little Cottonwood Canyon in the Wasatch Range in Utah. But its diminutive size is by no means its chief distinction. It is a municipal power-plant, built and operated by a city of 4,000 inhabitants, and as an illustration of what clean, municipal enterprise and management can do, it is claimed to be without a parallel.

Placed in operation but a few weeks ago, it has excited very great interest and very close scrutiny from small towns all over the West where water powers are obtainable for development, and from many other towns where steam power would have to be used.

For several years this little city of Murray had been served with electric lights and power by a large producing company, but there was water under tremendous headway coming through that canyon and running over the bench lands for irrigation. Very evidently great economy was the spur, and the city raised $80,000 and built this plant.

Arrangements were easily made with the irrigation water owners to use the power running to waste, and the house was built in the foothills two miles from the canyon mouth. The intake and dam are a half mile up the canyon, and the fall from the dam to the turbines is over five hundred feet.

From the intake to the house the water is conducted through a 30-inch wood stave pipe. There are two turbines and generators, each of 600 horse-power, and which can be operated as separate units or together. The current is generated at 2,300 volts; stepped up to 6,600 volts for transmission over the six miles of wires into the city, and there it is reduced again to the proper voltage for either power or light.

When that little city was buying its current for street-lighting and water-pumping the cost was close to $300 per month. Now that cost is entirely cut off. Not one dollar per month needs to be charged up to that public service, and although the income from the citizens for house lighting and power pays all operating expense, the rates to them have been astoundingly reduced. The lighting rate has been cut from 10 cents per kilowatt hour to 7½ cents; the rate for cooking and heating from 5 cents to 2 cents per kilowatt hour; and the rate for power is now 2 cents, against a former rate of 14 cents. On large, steady quantities of power, on day-load only, contracts are offered at less than 1 cent per kilowatt hour. In fact, 100 horse-power can be secured at a flat rate of $150 per month. As far as is known, no current is offered so cheaply by any plant, even in the great region of the innumerable water-powers of the intermountain country.

And, after passing through the turbines, the water runs into the irrigation canals. Not one pint of it is lost or wasted.

The operating force consists of a manager, whose office is in the City Hall, and who looks after the sales and distribution; two attendants at the power-house—one on day duty, the other on night; and an occasional intermittent inspector of the pipe-line and dam. There is no reservoir; a small covered settling basin serving every purpose, for those canyon streams, fed all through summer by melting snows on the high peaks and deep ravines miles back and up in the mountain range, never fail.

Electric Speed Indicator for Locomotives

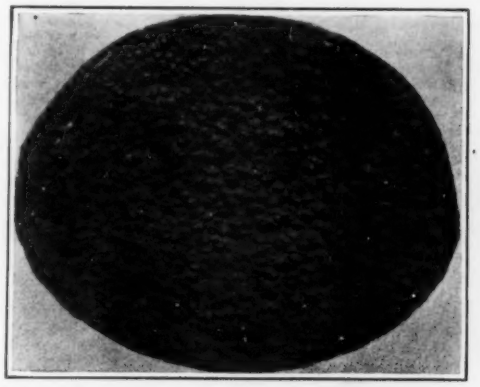
A NEW speed indicator for locomotives employs an electric system consisting of a small alternating current dynamo run from the axle, whose speed is proportional to the axle speed. The alternator sends current into an electromagnetic apparatus containing a set of small metal tongues or reeds placed opposite a magnet, the reeds being tuned so that only one of them enters into vibration, according to the rate of pulsation of the electric current. Alongside the set of reeds is a scale with figures, so that when any particular reed is seen to vibrate, the figure is read off, and this gives the rate of the current vibration, or in other terms, the number of revolutions of the locomotive wheel or the speed of the locomotive on the track. A suitable chart allows of direct reading the speed in miles an hour.

Rubber Foam

By Paul James

WHILE all the other parts of automobiles have been brought so nearly to a state of perfection that it is possible to travel thousands of miles without making repairs, the rupture and bursting of the pneumatic tires still constitute sources of delay and accident. None of the many spring devices proposed as substitutes for pneumatic tires has given good results in practice. A good pneumatic tire should be both flexible and elastic. India rubber is flexible enough, but it is not sufficiently elastic.

Small cylinders and sphere of unvulcanized rubber transformed into large cylinders and sphere of rubber foam.



Rubber foam as it appears in the microscope.

The solution of the problem appears to be furnished by a new material of remarkable properties, which is produced by an ingenious process in Paris. This product consists essentially of India rubber containing multitudinous minute bubbles of gas, distributed throughout its mass. The material resembles a rubber sponge in which the cavities are separate and do not communicate with each other. Hence it has received the name *"caoutchouc mousse,"* or rubber foam.

The process of manufacture is based on the increase of solubility of gases with increase of pressure. Rubber in the pasty stage of vulcanization is inclosed in a steel tube with nitrogen at a pressure of 3,000 to 4,000 atmospheres. The compressed gas dissolves in the semi-liquid rubber, which, when the tube is opened, expands to four or five times its former volume and solidifies, imprisoning in its mass myriads of little gas bubles, so that it resembles, in structure and properties, an assemblage of tiny rubber balloons.

The material, in fact, combines the properties of its two ingredients. It is as flexible as rubber and as compressible as a gas, so that it may be employed, in the form of a solid ring, in the place of the air tube of an automobile or bicycle tire. A tire so constructed is non-collapsible, for a puncture affects only a few of the innumerable gas bubbles.

Another valuable property of rubber foam is its lightness. Its density varies from 0.4 to 0.17, according to the quantity of gas forced into it. Hence, it is an excellent material for life-preservers and small folding life-rafts. It is also a very suitable filling for cushions and chair seats, and especially for horse collars, as it is light, imputrescible, and does not scratch or gall the skin if the cover is broken. It is also used in shoe soles, tennis balls, etc.

Rubber foam possesses still another valuable property. It is the best heat insulator known, and about twice as efficient as its nearest competitor. It has already proved its excellence as a lining for ice-boxes and refrigerating apparatus. Ordinary glass bottles, covered with a layer of rubber foam, keep liquids hot or cold.

Three-letter Linotype Matrix

A RECENT invention offers a new linotype matrix and attachment for the vise making the matrices three-letter instead of two, thereby saving the printer money in matrix fonts, and also in the time now used in changing magazines to obtain additional type faces. Three different faces of type, of any size up to and including 12-point, may be cast from one magazine without lessening the operator's speed in the least. Faces Nos. 1 and 2 are obtained in the ordinary way through the assembler, while a touch on the button on the vise gives the third face. Double-deck machines, having now four type faces, with this invention may carry six, three-deckers nine, and multiple-magazine machines twelve different type faces. Many job plants have only a dozen different faces in common use. The device permits the use of two type faces, besides the body type of any publication, from a single magazine. All that is necessary to make the change on the ordinary linotype of any model is a slight change in the attachment on the vise and on the mold. Any machinist can do the work in a very short time. No change whatever is made in the assembler, the lines being assembled exactly as with the two-letter matrix. Another advantage is found when it becomes necessary to recast lines. Now, on work where black and light faces are needed, lines must be reset or reassembled. With the three-letter matrix the lines may be recast without resetting. Many double-deckers in newspaper offices are used at a disadvantage because of the lack of a third face. The inventor is Mr. J. A. Quinn, of New York city.

A New Use for Concrete

IN building a ferry landing stage at Sydney, Australia, a big pontoon made of reinforced concrete was adopted. It was 100 feet long, 68 feet wide at one end and 43 at the other, and 7 feet 9 inches deep, giving it a freeboard of 32 inches. The bottom was flat, and the sides and ends were given an inclination of 70 degrees. The pontoon was divided into 48 water-tight compartments, and was carefully reinforced and strengthened to withstand the pressure of vessels lying alongside. A live load of 150 tons is provided for, and the structure weighs 650 tons. It is expected that this concrete structure will require little attention in the way of repairs, will be permanently water-tight and will overcome many other troubles that the ordinary wooden or steel pontoons are subject to.

The 30-inch wood stave pipe.

The 600 horse-power generating plant.

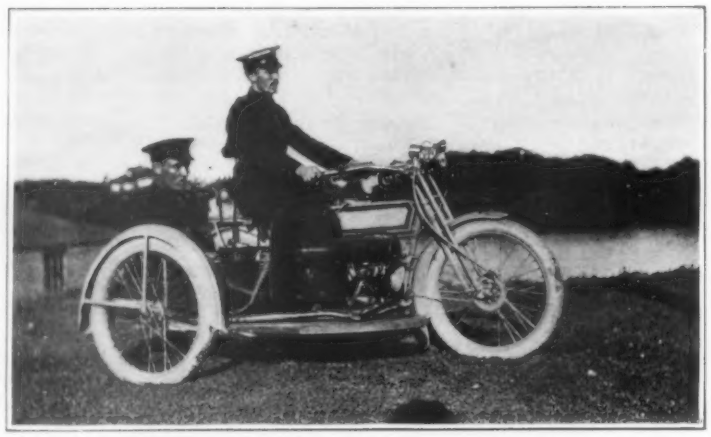
The dam in Little Cottonwood Canyon.

Compound Railroad Tie.—A railroad tie in which a metallic jacket is shrunk upon a wooden core is shown in patent, No. 1,102,-693, to Charles L. Seyler, of Academy, W. Va.

Motorcycle Machine Gun

THE designer of the new fighting machine shown in the accompanying photograph is Quartermaster-Sergeant H. R. Northover of the Ninetieth Regiment of Canadian Militia. The motorcycle with Maxim gun mounted on a sidecar chassis has a greatly increased radius of effective action as compared with other artillery. It can travel four miles per hour (the pace of infantry march) or be hurried to a distant point at a rate faster than forty miles per hour.

In the maneuvers at the barracks, when word was received that the Ninetieth Regiment probably would be in the first division from Canada to be sent to Europe, the motorcycle artillery was driven for two and one half hours through lines of people extending from the sidewalk to the middle of the road; it traveled through water and plowed fields; it went everywhere with the rest of the artillery. The chief advantage, however, of the motorcycle Maxim gun is its superior speed, compared with other artillery, and the rapidity with which it can be mobilized where needed for effective action.



A motorcycle machine gun.

Reconstruction of the Kiel Canal

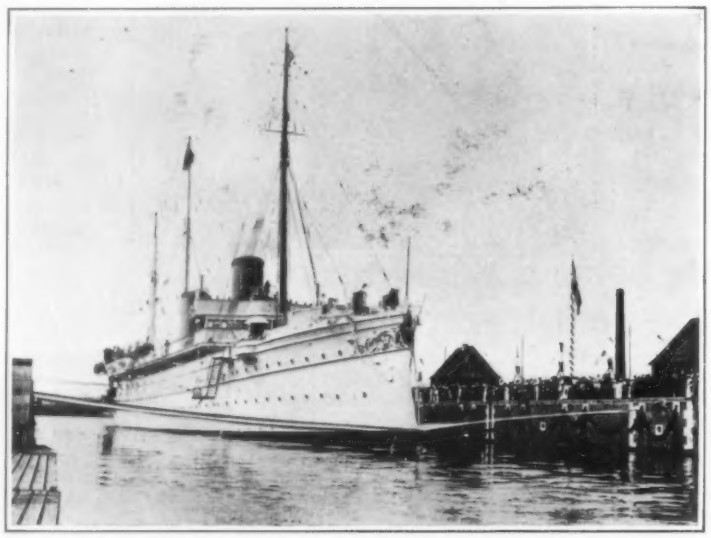
IN 1895, after eight years of hard work, the great canal running from the mouth of the Elbe, in the North Sea, to the Fjord of Kiel, in the Baltic, a distance of about sixty miles, was thrown open to commerce. It had a normal width of 72 feet at the bottom and 220 at the water level, with a depth of 29½ feet. Although a sea-level canal, twin locks were built at each end, those at the western entrance to take care of the large tide variations, and those at the eastern end to take care of variations of water level, in the practically tideless Baltic, due to gales. The locks were 492 feet long, 82 feet wide, and 32 feet deep. The locks at Kiel remained open most of the time, while those at the mouth of the Elbe did not need to be used at certain tides.

The canal proved wonderfully valuable to commerce, because it saved the long, hazardous trip around the stormy coasts of Denmark. But its strategic value to the German navy was of even greater importance, as has been demonstrated in the present war.

Although the locks, when built, were large enough to take almost all vessels, they were outgrown in time, even by warships, and finally it was decided to reconstruct the canal, making it broader and providing locks that could take the largest vessel afloat, with plenty of room to spare. This work was completed in time to be of incalculable value to Germany in the present war.

The normal width of the canal is now 335 feet at the surface and 144 at the bottom, with a depth of 36 feet. New twin locks have been built alongside the old ones at each end. They have an available length of 1,082.6 feet and width of 147.6 feet. Intermediate gates may be used to cut off a chamber 328 feet long. The locks at Panama, it will be recalled, are only 1,000 feet long by 110 feet wide.

The work of reconstructing the canal cost $55,000,000. The new locks were formally opened by the Kaiser, recently, in the manner shown in the accompanying illustration. The royal yacht "Hohenzollern" may be seen breaking a ribbon of black, white, and red stretched across one of the new locks.



The "Hohenzollern" breaking a ribbon of black, white and red, at the opening of the new Kiel Canal locks.

Draft Dogs in War

DOGS have long been used in the European armies for carrying messages from an advanced post or patrol to headquarters, for watching supplies and the like, for assisting sentinels on the advance lines, and for similar purposes. Shortly before the beginning of the present European conflict, dogs were introduced in the Belgian army as draft animals. American tourists who are at all familiar with Belgium will no doubt recall that dogs are used by the peasantry for the hauling of light loads. It is perfectly natural, then, that the Belgian military authorities should use dogs for the transportation of light machine guns. An interesting article on this subject appears by Capt. Oefele in a late number of *Umschau*. "In all armies but the Belgian," says Capt. Oefele, "machine guns and their ammunition are transported either upon ordinary vehicles drawn by horses or upon the backs of mules and horses. Belgium, which introduced the machine gun only this year, has built specially light vehicles for the transportation of the weapons and their ammunition. The first experiments were made with a single company. They were so successful that it was decided to adopt dogs for the transportation of machine guns throughout the army. Each of these machine gun companies consists of three officers, sixty-eight men, six transporting carriages drawn by dogs, and twelve ammunition carts, also drawn by dogs. It was intended eventually to supply each company with forty dogs, which were to be bred and trained at the main dog station at Beverloo. Hence, each company has four dogs in reserve, when its eighteen small carts are harnessed." This idea of transporting machine guns by means of draft dogs was an idea of the Belgian lieutenant van de Putte. A machine gun must be able to follow the infantry, no matter what may be the character of the ground, and must be as invisible as possible on the march as well as in action. Furthermore, a machine gun must be transported as noiselessly as possible and must be set up ready for action as quickly as possible. All these conditions seem to be admirably fulfilled by the system devised by Lieut. van de Putte.

"The gun carriages," continues Capt. Oefele, "are very light, and the harness is so designed that the movements of the animals are hardly impeded. The carts are provided with good springs; their axles run in ball bearings; the wheels are rubber tired; and the carts are so nicely balanced that the dogs need not be harnessed between poles, but simply hitched directly on traces. Each machine gun is drawn by two dogs. The load which can be thus transported is about 420 pounds.

The dogs must not be too heavy. They must be strong and possess considerable endurance. Dark colored dogs are preferred, because they are less conspicuous than light dogs. Still it has been found in practice that even yellow dogs may be used, if they are not too brightly colored. It is very essential, indeed, that the dogs should be anything but combative, and that they must not be given to barking. Hence, they must be trained, from puppyhood up, to silence.

In Holland experiments have also been made for the transportation of machine guns by draft dogs, in accordance with the Belgian system. A march of 129 kilometers (77.4 miles) was made in five days, the men, of course, traveling on foot. At night the dogs were fed and slept in stables on straw. They did not suffer at all. After this performance came the regimental exercises. Every day, from seven in the morning until four in the afternoon, the men were put through the usual drill. The dogs showed not the slightest sign of fatigue. They hauled the guns over very difficult ground and were always in position when wanted. While the guns were being fired, they lay quietly on the ground, and were ready on the first signal to haul the guns away to new positions.

During the autumn maneuvers of the Dutch troops the animals aroused general admiration. Their endurance and their obedience were remarkable. As soon as the command "Halt" was given or an equivalent signal, the dogs dropped to the ground of their own accord. They had been trained so well that they did not bark either during the maneuvers or during the night. After the maneuvers it was thought that they were probably fatigued. The inspector found them playing with one another. They were transported by railway with the machine guns in the same compartments in which the men sat; but although the railway journey lasted from 5 o'clock in the afternoon of one day until 1:30 the following morning, and the dogs were not fed in the meanwhile, they showed no signs of fatigue. They were inspected again fifteen days after the maneuvers, and were again found to be in perfect condition.

A Belgian dog-drawn machine gun.

Animals and Approaching Earthquakes

THAT animals are sensitive to the approach of earthquakes is a fact frequently observed, and the more recent seismic troubles in various countries give numerous examples of this singular faculty which many animals possess. For instance, in Japan horses set up an unusual agitation whenever a seismic shock is near at hand. In Central America, dogs and cats flee from houses, and the inhabitants have become so accustomed to this that they follow the example of the animals and leave their dwellings so as to escape danger. In Italy it was observed that birds left their nests and flew up to a great height in the air, but this without noise, before the earthquake took place. However, at the time when the earthquake shocks were produced the birds uttered cries which lasted for all the duration of the earthquake. It is stated that in Sicily cocks crow and dogs howl just before an earthquake.

RECENTLY PATENTED INVENTIONS

These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN.

Pertaining to Apparel.

ADJUSTMENT DEVICE.—D. O'DONNELL, 559 W. 171st St., New York, N. Y. The invention relates to men's trousers, drawers and like garments, and provides a new and improved adjustment device for use on the waistband of the garment and arranged to allow convenient adjustment of the waistband to properly fit the waist of the wearer.

SKIRT MARKER.—CORA E. MCINTOSH and O. A. MCINTOSH, care former, Chenango Forks, New York. The object of this invention is to provide a skirt marker arranged to enable a woman to quickly, accurately and conveniently mark a line around a skirt approximately at the hip, to permit of laying out the length of a skirt the desired distance from the floor.

Pertaining to Aviation.

AEROPLANE.—J. M. DAVIS, McGraw, N. Y. This inventor provides improvements in aeroplanes whereby upsetting is prevented in high winds, sudden gusts, or on the aeroplane's passing into air pockets, the arrangement being such that the aeroplane automatically rights itself if overturned, or if it should take a header for any reason whatever.

FLYING MACHINE.—M. D. FERRIN, 363 Chicago St., Salt Lake City, Utah. The present invention relates to flying machines, and more particularly to that type of flying machine which comprises side wings movable up and down and constituting the sole means by which the machine is enabled to rise from the ground and proceed either forward or backward.

Electrical Devices.

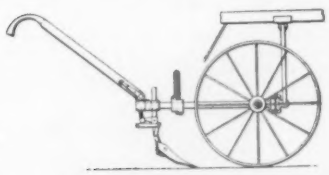
CONTACT INTERRUPTER.—A. H. MAIBRÉ and V. H. MARTIN, 92 Rue de la Republique, Rouen, France. This device is applicable to apparatus in which a part is to be caused to vibrate by electro-magnetic action with vibrations of very small amplitude. Among these appliances electric bells with direct vibration of the bell may be cited, the bell forming an armature of an electromagnet; also appliances termed electric trumpets in which the sound vibrations are produced by a sheet metal plate subjected to the action of an electro-magnet.

SYSTEM OF ELECTRICAL SELECTION.—N. L. TOLVSTAD, Groton, S. D. This system has a main circuit having between its two branches a series of cross shunt connections, each of which has in connection a current impeding means in the main circuit between each of the several cross shunt connections capable of being shunted or cut out of the main circuit in the direction of the same in which the selection of a cross shunt connection is desired, and means for cutting or shunting such current impeding means out of the circuit.

MEANS FOR PREVENTING SPARKING IN ELECTRICAL DEVICES.—L. GRUBMAN, 2309 Broadway, New York, N. Y. The principal object of this invention is to provide a new and improved core in electromagnetic devices, together with suitable means for varying the flow of the current, as to direction and amount, whereby the field may be reversed or controlled.

Of Interest to Farmers.

CULTIVATOR ATTACHMENT. — W. R. STURGISS, Conway, Ark. This invention is adapted for attachment to any cultivator, either walking or riding, and wherein thinning mechanism is provided consisting of two blades, and wherein the blades are so mounted that they may move toward and from each other, and wherein mechanism is provided for

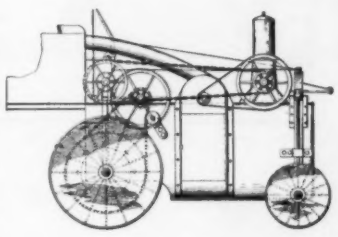


CULTIVATOR ATTACHMENT.

normally pressing the blades together to permit them to move together while thinning the row, and wherein mechanism is provided, under the control of the operator, for moving the blades apart to permit certain of the plants to remain in the row, the blades passing on opposite sides of the row when separated.

BROADCASTING MECHANISM.—J. E. PARRISH, 1105 Mutual Bld'g, Richmond, Va. This invention relates more particularly to an agricultural machine by which a supply of material may be constantly broadcasted within well defined limits as to direction and extent under control of the operator, the object being to provide a machine having certain features arranged to permit of the broadcasting of liquid and powder poisons, and various forms of fertilizer, as well as seeds of various sizes and kinds.

COTTON PICKER.—M. G. CUNNINGHAM, Corsicana, Tex. This improvement relates to a wheeled cotton picker having a power-driven suction means to pick the cotton and deliver it to a receptacle, and the invention more particularly relates to a structure in which a body of inverted U-shape directly mounts the run-



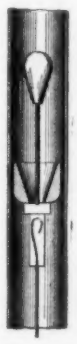
COTTON PICKER.

ning wheels, as well as a motor and the necessary driving connection to propel the vehicle and to operate suction fans arranged in connection with suction boxes on the body. These suction boxes cause the suction to be effective in a manner to act upon the cotton bolls as variously positioned on the plants of a row over which the U-shaped body is propelled.

Of General Interest.

VOTIVE OFFERING STAND.—G. B. BOHNE, 34 Barclay St., New York, N. Y. This inventor provides a receptacle for the money box used to receive votive moneys usually deposited in a stand specially provided therefor; and provides a cover for the receptacle and means connected therewith for detecting the removal of said cover to obtain access to the money-box.

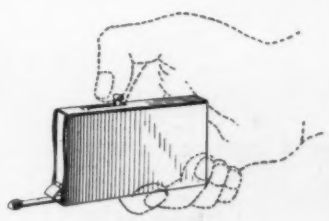
SNAKE PULLER.—F. A. THIES, 539 W. 50th St., New York, N. Y. This structure is designed to be forced into a pipe and to interlock with a snake therein so as to readily pull the same therefrom, even when the snake has become "stuck" or pinched in the pipe. The



SNAKE PULLER.

snake dislodging and removing device is formed with a loosely arranged mouse structure which has co-acting therewith a knob so as to grip the snake preparatory to the removal therefrom.

MATCH BOX.—S. STIGLICH and J. W. SCHNELLER, 155 Laurium, Mich. This invention relates to match boxes, and more particularly to those that are automatic in their action. One of the principal objects is to provide a box for automatically vending matches, one at a time, which will keep the matches free



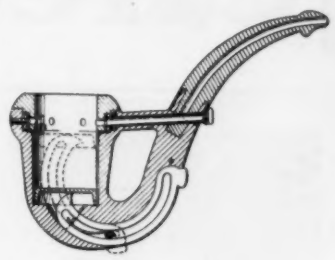
MATCH BOX.

from moisture. The matches are not projected entirely without the box, but extend only about half their length beyond the box, so that they may be grasped by the operator and withdrawn. The illustration shows a perspective view of the box, showing the same in operation.

DISPLAY RACK.—O. M. ARNOLD, care of Arnold, Shuff & Co., 85 Fifth Ave., New York, N. Y. This invention is for use in stores and other places, supports and displays umbrellas, canes or other articles, permits disassembling the parts into a small bundle for convenient shipping, allows the user to readily assemble the parts, supports the rack from a fixed support to facilitate the sale of the article, as the articles are singly displayed and can be readily examined as to the make and form of the handles or other characteristics of the merchandise.

EXCAVATING BUCKET.—J. J. HIGGINS, Silver Creek, Pa. Address James J. Moran, Pottsville, Pa. This bucket has means for suspending the same which may be readily attached to or detached from the bucket in a minimum time. The bucket has suspending means which are less liable to be broken than the ordinary bolts.

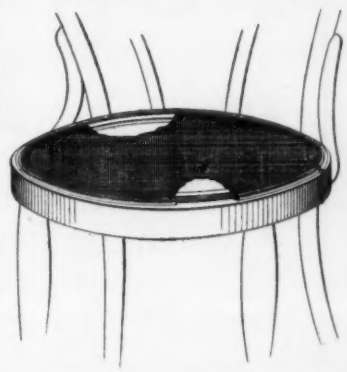
TOBACCO PIPE.—M. NEUMAN, 6314 Lowe Ave., Chicago, Ill. The purpose in this instance is to provide a pipe embodying certain novel parts, arrangement of parts and adjustments whereby the quantity and temperature of the



TOBACCO PIPE.

smoke may be regulated to suit the user, whereby to eliminate in a great measure the production of nicotin. The smoke is withdrawn from the bowl without necessitating its passage through the bulk of tobacco within the tobacco receptacle.

SEAT.—H. F. MEYER, 50 Himrod St., Brooklyn, N. Y. This invention provides means for securing seats to chairs, cars, lounges, etc. The seat may be constructed of cane, leather, cloth, or rattan, and is held in place on the seat frame and within a bead on the frame by bending the edge of the seat between the inner side of a U-shaped member and a slat disposed in the U-shaped member. This member is se-



SEAT FOR CHAIRS, CARS, ETC.

cured to the seat frame within the head, preferably by a strap which extends through the seat member and down at the inner side of the seat frame, the lower terminal of the strap being bent under and against the bottom of the seat frame.

AUTOMATIC HAND FIREARM.—A. FYRBERG, Warner Arms Corp., 96 Chambers St., New York, N. Y. This firearm is arranged to allow of quickly and securely fastening the barrel in position on the frame and allowing the removal of the barrel, to engage the sear with the firing pin in the rear of the magazine, and to control the sear from the trigger in front of the magazine, to relieve the main coil spring of the strain incident to firing, to prevent the breech lock from blowing out in case of breaking of the spring-pressed breech block guide rods, and to provide a safety device for preventing the sear from rising when the trigger is pulled, and to allow instantaneous release of the sear when desired.

HORSE PROTECTOR.—B. P. WELLAND, Bricelyn, Minn. This device is especially designed to protect the feet from injury by wire either barbed or plain, wherein mechanism is provided capable of attachment to the hoof, and comprising a horseshoe of a particular construction, and protecting mechanism supported by the shoe and by the hoof, the shoe being so arranged that it is not necessary to replace the same at frequent intervals, when used with young horses.

SAFETY BOTTLE HOLDER.—H. KENNELL, 1929 Amsterdam Ave., New York, N. Y. This invention provides a bottle holder for use on doors, in dumb-waiters, and in or on other devices, and is arranged to permit a milkman or other person to place one or more bottles into the holder to prevent removal of a milk bottle by any person except the one it is intended for, and to allow of placing empty bottles into the holder for convenient removal by the milkman or other person.

COMPASS WITH ANGULAR SHIFTING MAGNIFYING DEVICE.—G. E. COLOMBEL, 50 Rue de Moscou, Paris, France. This invention has reference to mariners' and other compasses and has for its object certain improvements which permit to exactly mark the position of the indicator corresponding to a given direction and to appreciate with great facility the displacement of the indicator relatively to this position.

MOLD FOR WALLS.—C. H. HARRIS, Kenosha, Wis. This inventor provides a wall mold having members so formed and arranged that upon the mold being placed in position, the members will automatically assume the proper positions to form the desired space for the material to be molded, and upon lifting the mold the members will automatically be given a separating lateral movement.

Heating and Lighting.

GAS LIGHTING AND EXTINGUISHING APPARATUS.—A. G. KENT-JOHNSTON, "Glencidon," Thurleigh Road, Balham, London, S.W., England. The object here is to reduce the resistance offered to the initial movement of the pressure member on account of the excessive compression of the gas on one side thereof, and to do so in such a manner that not only is the apparatus consequently rendered operable by a much smaller pressure increase, but also rendered more reliable in action than hitherto.

Household Utilities.

LATCHING DEVICE.—W. P. BANCROFT, Rostwick, Neb. This device is more particularly intended for use in connection with a swinging wringer support, to hold the latter in a given position. The device will hold a wringer support or equivalent element tightly in the fastened position.

GRIDDLE.—T. J. NASH, 235 N. 22nd St., Lincoln, Neb. An object here is to provide a device which is hinged along its center line and which is provided with handles for readily turning one of the sections so as to carry the article deposited upon it over the opposite section and to deposit it thereon.

OPEN AIR SLEEPING BED.—ELVA C. ANDREWS, Burbank, S. D. This invention provides a bed on which the head of the sleeper may be outside and the body on the inside of the building, whereby the sleeper can gain the advantages of sleeping in the open air and the body may be protected from the cold or other inconveniences of the weather. It provides means by which part of the bed may be readily and conveniently moved out of a window or other opening in the wall and as readily withdrawn, whereby the sleeper may avoid the storms or other annoyances of the weather or surroundings.

Machines and Mechanical Devices.

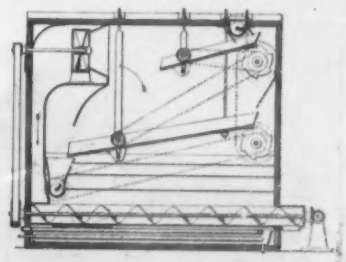
DEVICE FOR PRODUCING ALTERATIONS IN THE MOVEMENTS OF VALVES.—P. KIND, Turin, Italy. This device produces alterations in the times of movements of distributing valves in power engines in which the valves for controlling the introduction and exhaust of the motive agent are actuated from a distributing shaft by means of a cam or eccentric, and the object of the inventor is to provide a mechanism for this purpose arranged between the cam and the valve to be controlled.

CAKE CLOTH REMOVER AND TRUCK LOADER.—W. J. LOWRY, P. O. Box 1193, Waco, Tex. The object in this case is to provide mechanism having means for mechanically removing the press cloth from cotton and linseed cakes, and for afterward delivering the cakes to other mechanism for loading the same on a truck or the like.

VALVE.—S. BLOCK, care Weinburg, 302 Broadway, New York, N. Y. In this invention use is made of a valve normally held to its seat by a spring and capable of opening by fluid pressure whenever the latter exceeds the tension of the spring, an actuating device for moving the valve into open position, and a locking device controlled by the said actuating device for locking the latter against return movement to hold the valve open.

STUMP CUTTING MACHINE.—A. L. MOORE and G. D. MOORE, 1736 St. Charles Ave., New Orleans, La. This invention relates to a machine for removing stumps by cutting means adapted to be lowered from above the stump, and gradually fed to the latter until the complete stump is cut away, leaving only the minor roots, the action of the cutter being such as to cause the chips or shavings to be thrown outward by centrifugal force.

MACHINE FOR COOLING FINISHED OR UNFINISHED COCOA POWDER.—M. O. BUSCH, 212 Sixth Ave., Newark, N. J. This machine has to do more particularly with the cooling of the finished cocoa powder when it is reheated for the purpose of producing a darker product, or for cooling the unfinished powder received from the crushers. The gen-



MACHINE FOR COOLING COCOA POWDER.

eral object of the invention is to provide a machine which is thoroughly reliable and efficient in use, so designed as to have a large capacity and comparatively inexpensive to manufacture and keep in repair and operation.

MACHINE FOR GRINDING ROUGH FORGED BLADES OF KNIVES AND OTHER

The Jeffery Quad

Loading 37½ M. Red Cedar Shingles on a Jeffery Quad. This load is easily handled.

Rough work.

The Quad clambers out of a ditch.

The kind of work the Army gives it.

Carrying lumber to the side of the construction work.

The Quad handles trailers in addition to its own load.

Power on all Four Wheels

FRANCE went to war the other day, carrying her provisions on four-wheel-drive trucks.

The same day the Parsons Lumber Company, of Rockford, Illinois, enlisted a fleet of four-wheel-drive trucks for handling lumber.

The same week there gathered at Kenosha, Wisconsin, more representatives of more lines of business than ever before attended a similar conference. They came to witness the demonstrations of a four-wheel-drive, four-wheel-steer, four-wheel-brake motor truck.

The next week 300 motor car dealers, representing practically every state in the union, assembled for the same purpose.

Every day *this* week, and *every* week, demonstrations are being held at Kenosha—attended by business and transportation experts.

Moving pictures have been taken—to be shown in every part of the country. News articles have been written—run in class publications and newspapers. Transportation specialists are turning their eyes to Kenosha, Wisconsin. Dealers are buying—and selling to their customers.

The source of this suddenly aroused interest? How has it all happened so quickly?

An Army Officer Comes to Kenosha

Two years ago an American Army Officer, in his search for more efficient means of mobilizing troops, came to a Kenosha motor car maker.

He layed before this concern the high cost and slowness of the four-mule team method of moving supplies and ammunition. He pointed out the difficulties of operating with two-wheel-drive trucks under the adverse conditions which inevitably confront troops in active service.

The name of the motor car maker was The Thomas B. Jeffery Company. The most skilled Jeffery engineers and transportation experts were put to work on the problem. The result was the Jeffery Quadruple Drive Truck—now already beginning to be widely known as the Jeffery Quad—a four-wheel-drive, four-wheel-steer, four-wheel-brake motor truck.

The United States Government has been using the Quad for over a year in its Commissary and Aeroplane Corps. The Government is satisfied.

War, the destroyer, has been instrumental in developing a machine destined to become a vital factor in the progress of peace. Military necessity has given rise to a new high water-mark of efficiency in commercial motor trucking methods.

Business Gets the Benefit

The armies of the world needed four-wheel-drive motor trucks.

The Parsons Lumber Company and all business concerns with heavy hauling problems get the benefit. You get the benefit if you have heavy hauling to do. You get lower costs—greater speed in handling. You get a strategic advantage over competitors.

The oil producers of California are using Quads to pull their heavy-laden trailers over bad stretches of road. Mining concerns are buying. Quads are at work here and there through the great grain regions of the Northwest. Lumber dealers, department stores, wholesalers, city fire departments, brewers, coal merchants, contractors and builders—all businesses which do heavy hauling—are welcoming the Jeffery Quad.

Dealers are stocking up—already making sales.

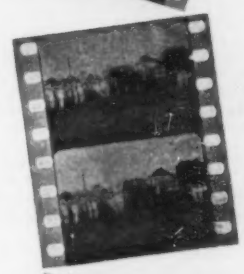
Taking its load up a 49% rough grade.

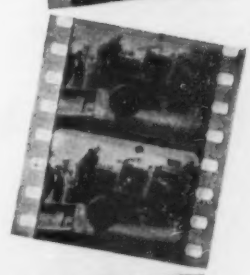
Will go anywhere a Four Mule Team can go

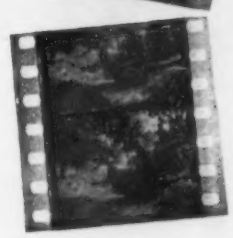
Quartermaster's supplies on a sandy road.

Heavy going.

Moving Pictures show the remarkable performance of the Quad







Built to meet the U. S. Army Specifications for a truck that will take its load "anywhere four mules can go." Drives, brakes, steers, on each of the four wheels

The Jeffery Quad goes anywhere where a four-mule team can go—through the deepest mud, over the steepest hills—carrying two tons and more on its back plus eight or ten tons on trailers. It pulls out of an excavation where the ordinary motor car or horse team cannot possibly move a load. The forward wheels climb while the rear wheels push. It accomplishes tasks that look impossible—does them easily—and *economically*.

Look at the Pictures on These Pages!

They are tame compared to the actual first-hand sight of the truck at work. But they serve to illustrate.

First the truck speeds up 200 yards—going 14 miles an hour—then stops within eight feet. Irresistible brakes, applied on all four wheels and drive shaft, are the secret.

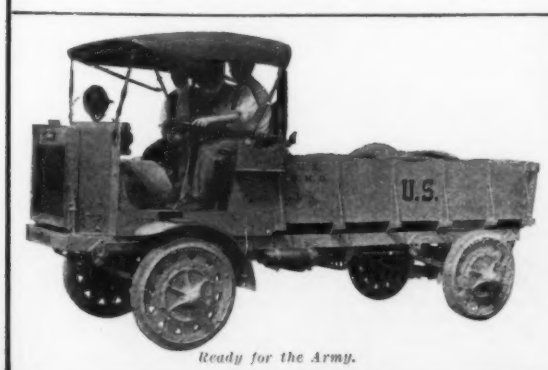
Picking up quickly, the Quad takes a series of three 16-inch hurdles, built of heavy planks piled one on top the other, presenting a perpendicular front.

A quick turn follows. All four wheels, actuated together, co-operate. Forty-two feet is all the space required for the complete turn.

From here the driver steers into a plowed field, where at times the mud is so soft the wheels sink in to the hubs. The Quad pulls through steadily without even hesitating.

Through this field there is a deep ditch, the sides of which form an angle of 45 degrees. The front wheels let the truck down into the hollow, then begin to climb the other side. The back wheels push. The Quad pulls out easily. It backs down in again; the rear wheels climb backwards, the front wheels push now. The task is done backwards with as great facility as forwards! Water in the ditch to a depth of 34 inches is no hindrance.

The last test of the series is the most spectacular. The driver approaches a 49% grade—lumber, piled in irregular steps. The Quad climbs. Holds itself at any point. Goes to the top. Backs down safely!



Ready for the Army.

The Meaning in Dollars and Cents

Your trucks will never have to climb piles of lumber. They probably will not have to negotiate deep ditches, nor travel over soft plowed fields.

But they do frequently have to travel over bad roads, through mud holes, and up steep hills. They meet with much rough going. Many times you ask them to bear heavier burdens than they can carry. Many times you wish they could pull heavier loads on trailers. Many times you spend money on slow, inefficient methods of hauling—you use horses and mules—because you haven't been able to get trucks that could do the work. Many times you lose business; you lose money because of delays—because your transportation facilities are *too slow—too uncertain*.

Read the Story of the Jeffrey Quad

Read it *now*—whether you are in the market or not. Read this story of achievement. It will be sent you free of charge—in answer to your signature on the coupon.

Read how the Jeffery Quad has won its efficiency, not through increased weight and expense, but through superior construction and engineering skill—how its tremendous power is generated by a small, light, high-speed power unit of the type made famous by Jeffery—how the wheels are turned by an internal spur gear applied, not on the hub but at a point half way to the rim, giving a powerful leverage—how the very slight excess in gasoline consumption is more than offset by the saving on tires—how the Jeffery Quad enables business men to solve their trucking problems at *low cost*.

Read the story *now*.

Post yourself NOW on this Ultimate type of truck

The booklet will be sent you free of charge—without obligation. We want the business men of this country to know and appreciate the Jeffery Quad. We are glad to furnish you with the facts.

What the Jeffery Quad Does

Pulls with all four wheels
Brakes on all four wheels and drive shaft
Steers on all four wheels
Carries two tons on its back
Hauls ten tons on trailers
Clambers over 16-inch hurdles
Goes through mud up to hubs
Travels through water 34 inches deep
Climbs out of ditches
Takes a 49% grade with load
Turns within 42 feet
Does its work with a small low-power motor
Economizes tires
Costs but $2750

The Thomas B. Jeffery Company also makes high-grade rear axle drive trucks which have given unusual satisfaction in many lines of business—a three-quarter ton and one and a half ton truck at $1,300 and $1,650 respectively. Complete body department maintained

The Thomas B. Jeffery Company

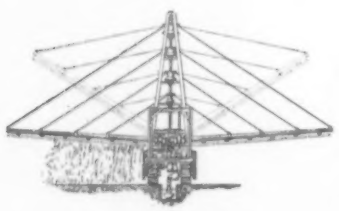
Main Office and Works, Kenosha, Wisconsin

The Thomas B. Jeffery Company Jeffery Kenosha, Wis. U.S.A.

CUTTING INSTRUMENTS.—P. PERGINAT, Thiers, Puy-de-Dôme, France. This invention has for its object to provide a machine for grinding the rough forged blades of knives and other cutting instruments however irregular their shape and whatever their dimensions. The machine may be employed, also, for grinding sword blades, razors, pocket knives, surgical instruments, and generally all instruments having cutting blades.

BRACE FOR DRILLING MECHANISMS.—J. M. HATFIELD, 408 W. Mulberry St., Robinson, Ill. The more particular purpose here is to provide a brace for use in connection with drills for the purpose of preventing displacement of the circle or track relatively to other parts, used in connection with wrenches, for the purpose of securing together the drilling stem and bit for disengaging the same.

TRAVELING IRRIGATOR.—J. C. SEARLE, care of Hind, Rolph & Co., 310 California St., San Francisco, Cal. This invention provides a machine preferably of a self-propelled nature, which is adapted to draw or to receive water from a ditch while progressing along or over the same, the machine being provided with

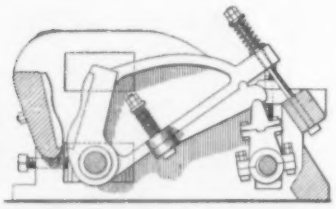


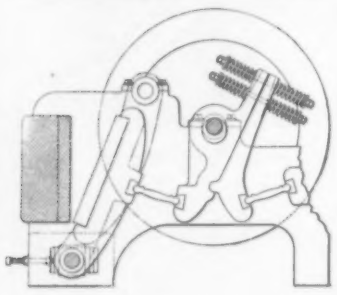
TRAVELING IRRIGATOR.

pumps or other suitable machinery whereby the water will be elevated and distributed over a wide portion of land on either or both sides of the machine while in transit.

HOISTING BLOCK.—S. LOWENSTEIN, 337 E. 13th St., New York, N. Y. The invention relates more particularly to automatic clutches whereby the load sustained by the block or tackle may be locked or held in any desired position, and whereby dropping of the load is prevented while the operator is performing the act of hoisting the load.

CRUSHER.—A. W. WARSEN, 1440 E. 15th St., Brookiyn, N. Y. This invention relates to crushers of the jaw type; and the object thereof is to provide a crusher by means of which material can be crushed to varying sizes, not exceeding a predetermined maximum. This object is obtained by providing a frame having a fixed jaw and an osciliating lever in the





CRUSHER.

frame having a jaw adapted to coact with the fixed jaw of the frame, the said lever being adjustably mounted in said frame and adapted to be reversed in the same. Furthermore, the means for actuating said lever are so connected to the same as to prevent a rupture in any of the moving parts of the crusher when an object of high resistance is located between the crushing jaws.

Musical Instruments.

PIANO HAMMER.—J. C. MILLER, 1601 S. 26th St., Lincoln, Neb. This invention relates to improvements in piano hammers, and an object of the inventor is the provision of a device by means of which the striking surface may be readily adjusted or renewed, or changed in its contour or texture.

Prime Movers and Their Accessories.

ENGINE STARTER.—H. W. BACHELDER, Herkimer, N. Y. This improvement has reference to internal combustion engines, and its object is to provide a new and improved engine starter arranged to permit an automobile or other vehicle to quickly and readily start the engine without resorting to cranking.

PISTON BEARING.—J. E. ERSKINE. Address G. Lunberg & Co., 119 N. 3rd St., Louisville, Ky. Mr. Erskine's invention provides a bearing, for connecting a piston or plunger with the crank shaft, so arranged as to permit a universal movement of the piston with respect to the rod, and a thorough lubrication of the bearing, and of the piston.

STARTING DEVICE FOR INTERNAL COMBUSTION ENGINES.—W. V. GILBERT. Address Day, Davies & Hunt, 321 High Holborn, W.C., London, England. Mr. Gilbert's invention is a starting device for internal combustion engines used on motor cars, aeroplanes and the like, in which it is necessary to cause an initial turning or revolution of the engine shaft or the like otherwise than by its own motive power.

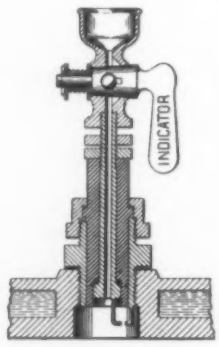
ENGINE STARTER.—F. MISKOVSKY, 38 Mento Ave., N. Lynn, Mass. The invention relates to an apparatus for starting automobiles or other engines, and it relates more particularly to a starting device in which a single actuating means in the first part of its movement relatively connects the starting shaft with the crank-shaft of the engine, and during the remaining part of its movement causes the starting shaft to rotate the crank-shaft sufficiently to enable the engine to start.

INTERNAL COMBUSTION ENGINE.—G. D. CASSON and F. D. BLAKELY, 812 Confederation Life Bld'g, Winnipeg, Manitoba, Canada. This invention comprises certain improvements in valve constructions for internal combustion engine motors, by means of which the entrance of the combustible gaseous mixture to the firing chamber and the discharge of the burnt mixture after explosion from the firing chamber can be more advantageously controlled.

ROTARY VALVE.—R. B. RANSOM, Sta. B, A. 7, Nashville, Tenn. The intention here is to provide a rotary valve arranged to cover the admission of the explosive mixture and the exhaust of the products of combustion in such a manner that the timing of the explosion is accurate and carbon deposits are prevented.

BEARING.—A. BONOM, Paterson, N. J. This invention pertains to bearings of the pedestal type, and has reference more particularly to turbine shaft bearings. An object is to provide a bearing having means whereby the journal therein is automatically oiled. Also to provide a bearing that will accommodate concentric shafts adapted to rotate in opposite directions and which will automatically oil the journals of both shafts.

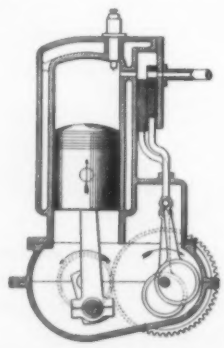
COMBINED SPARK PLUG, PRIMER, AND INDICATOR.—A. P. SEISS, 1104 South 13th St., Omaha, Neb., and G. W. ROHRIG, Council Bluffs, Iowa. This invention relates to spark plugs for internal combustion engines, and it is a design of the inventors to provide a spark



COMBINED SPARK PLUG, PRIMER, AND INDICATOR.

plug and appurtenances which, in addition to the usual functions of the plug in producing the ignition spark, will serve as a primer and also serve to indicate whether a particular cylinder is doing its work, or doing it properly.

INTERNAL COMBUSTION ENGINE.—E. H. SHATTUCK, Granby, Hartford Co., Conn. This invention relates to an improvement in internal combustion engines, and particularly the valve gearing on such engines, by which the inflow and outflow of the gases of such en-



INTERNAL COMBUSTION ENGINE.

gines are controlled; and the primary object thereof is to produce an engine of this type which will be perfectly noiseless in operation and be characterized by a smaller number of parts than prior motors of this type.

GRINDING TOOL FOR GAS ENGINE VALVES.—C. L. BALDWIN, care of Dr. Merle Casey, Almond, Wis. An object of this improvement is the provision of a hand tool having a valve-engaging head connected with a stem or shaft to which rotation is imparted by one hand of the operator through suitable means, while pressure is exerted through the tool on the valve by the other hand, so as to hold the valve in grinding relation to its seat.

Railways and Their Accessories.

RAILROAD TIE.—G. H. STRAND, Lincoln Co., Merrill, Wis. This improvement provides a railroad tie constructed of two resilient slotted members engaging each other at the slots, and each having two ends, one of the ends of each of the members being coiled and disposed within the other turned back end of the other member on which the rail rests.

SPLICE BAR.—W. J. SMITH, 1501 Gaty Ave., E. St. Louis, Ill. This inventor provides an attachment for securely joining the meeting ends of rails, without the use of bolts or the like passing transversely of the rail, and wherein mechanism is provided for securely anchoring the rail ends in alinement, to the tie, without requiring any transverse opening in the rail or the connecting means.

PREHEATER.—G. H. WILSON, Orchard Ave., Spokane, Wash. This invention relates to feed-water preheaters for locomotive boilers. The aim is to provide a tubular preheater which may be easily cleaned and which will utilize the heat of the hot gas entering the smoke box, as well as that of the exhaust steam.

CAR COUPLING.—C. H. KADIE, Strasburg, Va. This invention relates to couplings of the general type known as Master Car Builders' automatic couplings, the general purpose of which is to reduce to a minimum the dangers peculiar to the coupling of cars and also to save time in coupling. This is accomplished by rendering the coupling more efficient, reliable, safer, and more convenient to operate, and to obviate the necessity of trainmen going between the cars for coupling and uncoupling.

Pertaining to Recreation.

CAROUSEL.—P. RYAN, 347 E. 30th St., New York, N. Y. In this carousel horses or seats are caused to have traveling movement through a given path, and the invention relates particularly to an apparatus having means for mounting the seats and their propelling means on a traveling vehicle, preferably motor-driven, whereby the carousel may be transported from place to place, and be ready for immediate operation.

Pertaining to Vehicles.

AUTOMATIC FENDER.—B. PÉDUCASSE, care of N. Delorme, 71 W. 23rd St., New York, N. Y. This invention relates to an automatic fender for cars, vehicles, and the like, which is adapted to be extended automatically by the impact of a person on the vehicle or by manual means operated by the motorman. The device is inexpensive to make-up and easily operated.

VEHICLE WHEEL.—T. FITZ E. HUTCHINGS, 218 W. 58th St., New York, N. Y. Among the principal objects which the present invention has in view are: to provide a tire rim and tire removable from, and attachable to, the felly rim of a wheel; and to provide means for rapidly removing and replacing rims and tires of the character mentioned.

REAR SIGNAL FOR VEHICLES.—M. E. WALSH, 177 Adelphi St., Brooklyn, N. Y. This invention provides a signal apparatus readable at the rear of a vehicle to show the purpose of the driver of the vehicle; provides an operating mechanism for a signal, which is simple and efficient; and provides operating means for the apparatus, to avoid interference of the various signal devices, and to secure a desired precedence of the signals.

ILLUMINATED INDICATOR.—SAMUEL W. BROWN and W. H. MICHAEL. Address the former, 232 N. Custer Ave., Colorado Springs, Colo. This invention relates to improvements in illuminated indicators as used on rear ends of vehicles, and has reference more particularly to a device comprising a telescoping casing carrying the indicator, and a lamp associated with the casing for illumination of the indicator.

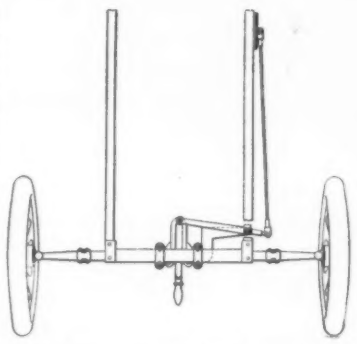
TRACTOR WHEEL.—J. BEARD, Knowles, Cal. This improvement refers to a self-laying track for tractor wheels. It provides a track of the character that the tractor wheels may more readily mount obstructions in the road, and so constructed as to minimize the possibility of picking up trash, sand, etc., from the road.

STEERING APPARATUS.—S. JACOBSON and F. E. ANDERSON, Lynch, Neb. In this case the invention is an improvement in steering apparatus for carts and the like, wherein mechanism is provided operated by the feet of the driver, for simultaneously swinging the wheels on a vertical axis, to steer or guide the vehicle.

WHEELED SCRAPER.—W. H. VIOLETT, Rifle, Colo. This invention relates to wheeled dumping scrapers of the class in which the scoop is connected with a crank axle and the latter operated by a lever for the purpose of vertically adjusting the scoop, and the object is to provide draft connections whereby the scoop may be raised after being filled without necessitating manual use of the lever before mentioned.

AUTOMOBILE CLOCK.—E. HEROLD, Brooklyn, N. Y. This invention provides novel winding and setting mechanism for time movements whereby keys and pendants may be dispensed with, such winding and setting mechanism embodying a ring which when turned in one direction sets the hands, and when turned in the opposite direction winds the spring, only one of such mechanisms being in gear at the time, the other being automatically thrown out of gear.

SAFETY CRANKING DEVICE FOR AUTOMOBILES.—A. J. ZLOTORZYNSKI, 1001 E. Race St., Shamokin, Pa. This inventor provides a device which has a U-shaped member for engaging the crank, the U-shaped member being connected by a lever and rod with the clutch lever of the automobile. When the clutch lever is



SAFETY CRANKING DEVICE FOR AUTOMOBILES.

in neutral position the U-shaped member is held out of engagement with the crank, but the movement of the clutch member into operative position, throws the U-shaped member by means of the first lever and the rod into position to embrace the crank and prevent its rotation.

COMBINED AIR COMPRESSOR AND MOTOR.—D. E. CROUSE, C. G. EDISON, and T. DAVIS, care of Auto Air Appliance Co., Industrial Bldg., Baltimore, Md. This device may be used either as a means for compressing air or as a motor. It is particularly adapted for use as a starting device for automobiles, and also as a means for compressing air for driving the starting device.

Designs.

DESIGN FOR RIBBON, AND PARTICULARLY FOR BROCADED WOVEN RIBBON.—J. W. MACLAREN, and E. SPECK, care of Johnson, Gowdin & Co., 126 Fifth Ave., New York, N. Y. This ornamental design for a ribbon represents a band of fabric adorned with widely separated flowers on a stem and with leaves.

VANITY CASE.—A. BIENENZUCHT (Bienenzucht Bros.), 109 Spring St., New York, N. Y. In this design the form is oblong with rounded corners, the edge comprising an ornamental twisted cord, which also runs across the center. A small mirror is attached at the upper portion.

ORNAMENTAL DESIGN FOR A RAIN COAT.—N. M. BUSH, care of Edward McConnell & Co., 13 E. 22nd St., New York, N. Y. In this ornamental design for a rain coat the garment is buttoned at the sides. A hood surmounts the coat which is plain in front. The back is belted and the sleeves form a cape effect at the back.

DESIGN FOR A BUTTON.—J. F. BYRNE, care of City Button Works, 374 Second Ave., New York, N. Y. In this ornamental design for a button the article is of oblong shape, and its plan view, side elevation, and end presentation show a button of attractive and graceful lines.

NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

WE wish to call attention to the fact that we are in a position to render competent services in every branch of patent or trade-mark work. Our staff is composed of mechanical, electrical and chemical experts, thoroughly trained to prepare and prosecute all patent applications, irrespective of the complex nature of the subject matter involved, or of the specialized, technical, or scientific knowledge required therefor.

We also have associates throughout the world, who assist in the prosecution of patent and trade-mark applications filed in all countries foreign to the United States.

MUNN & CO.,
Patent Solicitors,
361 Broadway,
New York, N. Y.

Branch Office:
625 F Street, N. W.,
Washington, D. C.

LEGAL NOTICES

OVER 65 YEARS' EXPERIENCE

PATENTS

TRADE MARKS
DESIGNS
COPYRIGHTS &c.

INVENTORS are invited to communicate with **Munn & Co., 361 Broadway, New York,** or **625 F Street, Washington, D. C.,** in regard to securing valid patent protection for their **Inventions, Trade-Marks** and **Copyrights** registered. **Design Patents** and **Foreign Patents** secured.

A Free Opinion as to the probable patentability of an invention will be readily given to any inventor furnishing us with a model or sketch and a brief description of the device in question. All communications are strictly confidential. Our **Hand-Book** on Patents will be sent free on request.

Ours is the **Oldest** agency for securing patents; it was established over sixty-five years ago.

All patents secured through us are described without cost to patentee in the **Scientific American.**

MUNN & CO., 361 Broadway, New York
Branch Office 625 F St., Washington, D.C.

Classified Advertisements

Advertising in this column is 75 cents a line. No less than four nor more than 12 lines accepted. Count seven words to the line. All orders must be accompanied by a remittance.

BUSINESS OPPORTUNITIES

START an original mail-order business. Honest, independent. Small Capital. New Methods. Sole Rights. Big Money. R. Clement Moore, Business Specialist, New Egypt, N. J.

CHEMICAL ANALYSIS and duplication of commercial products. Report and opinion on chemical patents, formulas and processes. Address Dr. Balke, Analytical Laboratories, 103 Park Ave., N. Y. City.

WANTED—Responsible party to take charge of business in each county. New Automatic Combination Tool, combined wire fence stretcher, post puller, lifting jack, etc. Lifts or pulls 3 tons, weighs 24 pounds. Sells to farmers, shops, teamsters, etc. Descriptive catalogue and terms upon request. Harrah Manufacturing Co., Box A, Bloomfield, Ind.

AGENTS. 500% Profit. Free Sample Gold and Silver Sign Letters for store fronts and office windows. Any one can put on. Big demand everywhere. Write today for liberal offer to agents. Metallic Letter Co., 438 N. Clark St., Chicago, U.S.A.

INSTRUCTION

LEARN TO WRITE ADVERTISEMENTS.—Earn $25 to $100 weekly. We can positively show you by mail how to increase your salary. Prospectus free. Page-Davis Co., Dept. 89, Chicago, Ill.

SALESMEN making small towns, should carry our fast selling pocket side-line. Special sales plan allowing return of unsold goods makes quick easy sales. $5 commission on each order. $5 to $15 daily profit for full time. Something new. Write for outfit today. Canfield Mfg. Co., 208 Siegel St., Chicago, Ill.

CLAY WANTED.

LARGE MANUFACTURER WANTS TO PURCHASE quantity of Klingenberg or other German or Austrian clay, or a similar American clay. For further particulars address C. A., Box 773, N. Y.

Prosperity and Power for You

LAW LEARN AT HOME

Become a Lawyer and success awaits you—power, dignity and independence—$5,000 to $10,000 yearly. Hundreds of big salary positions now open with big firms. **You** can master Law—our simplified method trains you at home in spare time, by mail. Course written in plain language by greatest professors. Endorsed by legal experts. Our method like that used in big Universities. Degree of LL. B. conferred. Course prepares you to pass all subjects required in bar examinations—we guarantee to coach you free until successful. **Complete Law Library Furnished** if you enroll now.

COMPLETE COURSE IN PUBLIC SPEAKING **FREE** Written by Dr. Frederick B. Robinson, Professor Public Speaking in the College of the City of New York, Editor Public Speaking Review, Public Lecturer for New York Board of Education, etc. Greatest course written—greatest offer out—absolutely FREE to you. Write quick for free facts. Everything sent Free.

LaSalle Extension University, Dept. F-245 Chicago, Ill.

FREE ANY ONE OF THESE INSTRUCTION BOOKS

"Water Meter Inspector" "Plumbing Inspector" "Examiner of Charitable Institutions Examination"

With one year's subscription to *The Civil Service Magazine*, $2.00 postpaid, U. S.

Home Dept., Civil Service Publishing Co.
225-229 West 39th Street, New York

WE TEACH Retail Advertising, Window Trimming, Show Card Writing, Salesmanship

In order to acquaint you with our school and methods of instruction, we will mail you *free* our new fifty cent book, entitled

TEN DISPLAY MANAGERS TELL

HOW TO SELL IT

With this free book we will also include our complete list of over one hundred fifty business books, especially suitable for the retail store's library. A postal request will bring both.

Economist Training School 231-243 W. 39th St., New York City

LEARN WATCHMAKING and become independent. Refined, profitable labor. *Good-Paying Positions Secured.* Competent men always in demand. Easy to learn; money earned while studying. Write for our Catalogue. Address, St. Louis Watchmaking School, Dep't 6, St. Louis, Mo.

PORTLAND CEMENT MAKING is described in excellent articles contained in Scientific American Supplements 1433, 1465, 1466, 1510, 1511. Price 10 cents each. For sale by Munn & Co., Inc., and all newsdealers.

Notes for Inventors

A New Way of Fastening Cardboard Boxes.—Packing cardboard boxes by the use of cord is very likely to spoil the box by making grooves at the edges. There has appeared on the market a clever device in the shape of a small metal angle-piece of very light weight. The piece has two stamped points for holding it in place when slipped on the edge of the box, and a groove in the corner of the metal serves to hold the string and keep it from slipping. One of these pieces is put on wherever the string meets the corner of the box, and it thus acts to prevent any damage to the latter.

Making Wood Out of Straw.—If we are to believe the *Moniteur des Scieries*, wood can now be made out of straw, this being a real wood without grain or knots which can be sawed as usual and also turned in the lathe. The "wood" is molded in the shape of plank, lath and round sticks. In the process which is said to be used in France, straw is cut by machine and then reduced to paste by a heating process, employing chemical products whose nature is not exactly known, but probably caustic soda is used here. The paste is then compressed in molds of suitable shape. Such product is of the hardness of poplar wood, and can be worked as easily. It burns like real wood but gives a large flame and little smoke, so that it will find a use in the match making industry. It will also be very good for making light and strong packing boxes, so that these two applications will already assure it a wide use in the industry.

Patents in India.—U. S. Consul Henry D. Baker, of Bombay, advises American manufacturers who contemplate selling many devices susceptible of imitation in India to take out patents in that country, and says, "It is not at all uncommon for Indian native dealers to order from other countries a particular article or machine, not with the expectation of importing it in the future, but merely to study it and locally manufacture copies of same."

A Montessori Educational Device.—Maria Montessori, of Rome, Italy, has secured U. S. patent, No. 1,103,369, for an educational device involving didactic material for instruction of children, in which a number of units bearing designs having roughened surface upon which the ball of the child's finger operates, are utilized.

An Electric Wrench.—Eugene Woodland Burroughs, of Norfolk, Va., in a patent, No. 1,102,240, provides a wrench especially adapted for use in connection with railroad tracks for operation by an electric motor.

An Advertising or Displaying Device.—In a patent, No. 1,102,270, Charles Lowell Howard, of Washington, D. C., shows an advertising spectacular or decorative device in which a flag is given such motion as is produced by a natural current of air.

Bed Clothing Converted into a Garment.—Ida Marie Maximiliane Ernestine Hubner, of Dresden, Germany, has patented, No. 1,102,408, a coverlet for a couch, cot or bed, chiefly for hospitals, sanitariums, etc., which can be utilized to cover the patient when recumbent, or as a garment to be worn by the patient when he rises from the bed,

Preventing Moths in Wardrobes.—A wardrobe has been patented, No. 1,097,844, by Clyde J. Coleman, of New York city, for protection against moths by displacing the air in the wardrobe automatically and filling the wardrobe with a non-respiratory gas upon the closing of the door.

An Elihu Thomson Spot-Welder.—In patent No. 1,097,895, to the Thomson Electric Welding Company, as assignee of Elihu Thomson, is shown an apparatus by which to secure a spot-welding, for instance, of two sheets of metal, by simply feeding the same between two wheels, rolls or disks, welding electrodes being suitably provided.

An Illuminated Deceptive Advertising Device.—A patent, No. 1,097,922, for the invention of Frank H. Feraud, of Granite City, Ill., assignor to Edward S. Briggs, of St. Louis, Mo., presents an illuminated sign embodying a large plate of glass bearing a lamp, and in which the problem is as to the source of the current for the lamp.

Which Will Succeed?

Each has only a few hurried moments for reading. One spends *all* his precious moments with the daily paper. The other, little by little, is gaining that knowledge of a few truly great books which will distinguish him always as a *really well read* man.

What are the few great books—biographies, histories, novels, dramas, poems, books of science and travel, philosophy and religion that "picture the process of civilization"? Dr. Charles W. Eliot, from his lifetime of reading, study and teaching—40 years of it as president of Harvard University—has answered that question in

The Famous Five-Foot Shelf of Books

"418 Masterpieces at the cost of 40."
If you expect ever to buy another book, you should know what few books in the world are really worth buying.
You should have the expert advice on your reading that is here offered free.

A Free Booklet—For You

Accept with our compliments the interesting story of the Five-Foot Shelf of Books; it tells how Dr. Eliot from his years of experience, choose the *best possible library for the modern busy man.*

The booklet is free; no obligations, merely clip the coupon.

P. F. Collier & Son, Publishers of Good Books

St.Am. 9-1914

P. F. Collier & Son, 416 W. 13th St., N. Y. City: Mail me without obligation on my part, your free "Guide Booklet to Books" containing the story of the Five-Foot Shelf.

.....

.....

.....

If you have children and are interested in what they read, put a ✓ in this square ☐

The result of 22 years' successful experience in building motor cars

America's Greatest "Light Six" $1485

The Man Who Cares For His Own Car

—**will *now* find a car** on the market which was primarily designed to meet his requirements.

Nothing has been sacrificed from an engineering standpoint. Practically all working parts are completely enclosed. Yet *accessibility* is one of the chief features of its construction. This car is

THE **HAYNES**

America's Greatest "Light Six"

The grease cups and oilers may be easily reached; the carburetor is conveniently located; the valves are readily adjustable; the motor and generator are very accessible; storage battery conveniently placed—in fact every part and every unit has been carefully considered from the standpoint of the *owner*, making this car particularly well suited to the man who prefers to care for his own machine.

In addition to these desirable features this car represents a sterling value in a high grade, light weight, economical "six" with ample power.

We also build Model 31, "Big Six" with 65 brake horsepower and 130-inch wheelbase—$2250; Model 32, Haynes "Four" with 48 brake horsepower and 118-inch wheelbase—$1660.

THIS COUPON WILL BRING YOU OUR LATEST CATALOG

WRITE NOW TO

THE HAYNES AUTOMOBILE COMPANY -- 46 South Main St., Kokomo, Ind.

Please send me your 1915 catalog with full particulars in regard to America's Greatest "Light Six".

Name ..... Address .....

.....

I expect to buy a car about .....

What the Telephone Map Shows

56.8% Exchanges Bell-connected, but not Bell-owned.

23.5% Exchanges Bell-owned.

10.5% Exchanges not Bell-owned or connected.

9.2% Places served by two companies.

EVERY dot on the map marks a town where there is a telephone exchange, the same sized dot being used for a large city as for a small village. Some of these exchanges are owned by the Associated Bell companies and some by independent companies. Where joined together in one system they meet the needs of each community and, with their suburban lines, reach 70,000 places and over 8,000,000 subscribers.

The pyramids show that only a minority of the exchanges are Bell-owned, and that the greater majority of the exchanges are owned by independent companies and connected with the Bell System.

At comparatively few points are there two telephone companies, and there are comparatively few exchanges, chiefly rural, which do not have outside connections.

The recent agreement between the Attorney General of the United States and the Bell System will facilitate connections between all telephone subscribers regardless of who owns the exchanges.

Over 8,000 different telephone companies have already connected their exchanges to provide universal service for the whole country.

AMERICAN TELEPHONE AND TELEGRAPH COMPANY
AND ASSOCIATED COMPANIES

One Policy One System Universal Service

WAR NUMBER SCIENTIFIC AMERICAN

48 PAGES—110 ILLUSTRATIONS

WAR MAP IN FOUR COLORS
SIZE OF MAP 19 x 14 INCHES

An Authoritive Handbook of the War. Every Article in this Number is Written by an Expert of National Reputation

ARMY SECTION

- Comparative strength of belligerents.
- Their Armament.
- Signal and telegraph service.
- Medical and ambulance service.
- How the vast armies are fed in the field.

NAVY SECTION

- Comparative size and strength of the navies of the belligerents.
- Contending navies in detail.
- Naval guns, caliber, weight, velocity energy, etc.
- Aeroplanes and Dirigibles in modern warfare.

Superb illustrations showing all phases of Army, Navy and aerial warfare.

FOR SALE BY ALL NEWSDEALERS,
or sent postpaid on receipt of 25 cents

SPECIAL TRIAL SUBSCRIPTION

For One Dollar we will send the Scientific American to you each week until December 31, 1914, commencing the subscription with the great WAR NUMBER.

MUNN & CO., Inc., *Publishers*, 361 Broadway, New York City

An Automobile Radio-telegraph Station for War Use

(Concluded from page 228.)

bipolar interrupter, a bipolar circuit breaker, and two safety lamps connected in series between the terminals of the alternator, with the wire between the lamps connected to earth.

For sending wireless messages the station employs an alternating current of 500 cycles, which produces a loud, pure, and constant musical tone. The primary circuit of the sending apparatus is greatly damped by the employment of a divided discharger, which can be regulated with great precision. When the antenna is excited in this way it sends out waves of uniform length which are very easily tuned. As is well known, this uniformity in length of the aerial waves depends only on the damping of the exciting circuit, is entirely independent of the nature of the connection, and does not require the circuit to be tuned to exact syntony with the antenna. The wave-length may then very gradually within wide limits without affecting the transmission of messages. The wave-length can be changed very easily without re-tuning the circuit and the antenna. The energy transmitted to the antenna can be modified very quickly by regulating the sparking distances. This is accomplished by means of a micrometer screw, which acts on all the spark gaps simultaneously.

The discharger is so designed that the discharges are almost silent, a condition which is particularly desirable for a military field station in war.

The sending apparatus comprises:

1. An oscillating circuit composed of condensers, a discharger, and a resonator.
2. A key having copper contacts immersed in petroleum oil.
3. A rheostat by which the load on the alternator can be kept constant during transmission.
4. A commutator by which the antenna can be instantly disengaged from the sending apparatus and connected with the receiving apparatus, or conversely, by a single movement.
5. An amperemeter which indicates the amount of energy transmitted to the antenna.

The receiving apparatus includes a combination of condensers and resonators which has very little damping, and greatly facilitates the elimination of stray waves. The variable condensers contain no dielectric except air, while the coils are of minimum ohmic resistance and are arranged so as to produce the minimum mutual induction. This combination presents great advantages for the reception of waves of little damping, although its efficiency is not diminished when less syntonizable waves are received. Two definite receiving positions have been adopted: a position of expectation, which is most suitable for rapid exploration of the Hertzian field; and a position of syntony, which makes it possible to obtain great sensitiveness and to eliminate disturbing waves. The station can be adapted to receive signals of any wave-length between 200 and 2,500 meters.

A dynamo and accumulators for electric lighting, and a number of non-electric emergency lamps complete the equipment of this autmobile wireless station, which is as remarkable from the mechanical point of view as it is from that of wireless telegraphy.

Time as a Factor in Baseball

(Concluded from page 229.)

the batter, hitting at an unexpected "fast one" will make a foul (if he hits it at all) more often than anything else. He hits so that his bat meets the ball behind him, not beside him, and it angles off to right or left beyond the foul lines. But when Frank Baker does bring those mighty shoulders against one of Walter Johnson's fast balls—why then it's a home run over the fence!

If further proof is needed, it is found in the amazing fact that the best "arms" in the business can throw a ball farther than the most powerful batter can bat a ball tossed—not pitched—in the air. The record throw is 426 feet 9½ inches, made by Sheldon Lejeune in 1910. The record batted ball (not made in a game or from a pitched ball, but from a ball tossed in the air by a "fungo" batter) is 419 feet ½ inch, made by Edward Walsh in 1911. There is no record of the length of the longest fly batted from pitching, for an excellent reason. A small boy outside the fence always makes off with the ball before an over-fence home run drive can be measured! It is probably well over 500 feet.

At the rate of 120 feet a second it takes one half a second for the ball to get from the pitcher's hand to the batter at the plate. It is the fact that this time is so small, which accounts for much of the pitcher's power over the batter. Half the time a pitcher "fools" a batter it is not because the latter didn't *see* the curve of the ball or note that the ball was a "floater" (one pitched slowly), but because there wasn't *time* for his "nervous reaction" to work between his recognition of the fact and the instant he must act on his knowledge. A "floater," for instance, "looks like a balloon," as the player says. The ball seems *big*—he can see the seams on it. If he knew it was coming before it left the pitcher's hands, he could—and probably would—knock it over the fence. But he has expected a curve or a "fast one." His muscles are all "set." The shoulder muscles tighten and the swing commences almost as the ball leaves the pitcher's hands. Suddenly, when the ball is almost upon him, the batter sees it is "big" and "slow." But that swing is started. The mind has been made up. The brain has telegraphed its instructions. Spite of his will, the bat swings—and after it has passed over the plate, the ball passes lazily by the batter into the catcher's mit.

"Psychology," says the professor.

But it actually is *time*—time and balance between distance, between speed of batted ball and thrown ball, between speed of mind and speed of muscle. While this balance is left undisturbed, baseball will always be uncertain—always be a contest and always have that fascination for the "fan" that it has now—the uncertanity and the hazard epitomized for generations of ball players and fans alike in the aphorism,

"You never know the winner till the last man's out!"

Switzerland Asks for Help

THE little Republic of Switzerland is making an appeal to the world for help, for she has been reduced to dire straits by the terrible European war that is being fought on her borders; and while the appeal is addressed particularly to her children who are enjoying peace and prosperity in other lands, she also seeks assistance of the many friends who have enjoyed her hospitality in other years.

As a result of the hostilities on her borders Switzerland has been obliged to mobilize her entire army of 300,000 men, not for offense, but solely to defend her neutrality, at an expense of $230,000 a day, while her entire revenues amount to only $16,000,000 a year. This heavy expense has not only depleted her exchequer, but with all her able-bodied men in military service her industries are at a standstill and her harvests have had to be left to the feeble hands of the aged, the women and children. The result is that thousands of families are now without the bare necessities of life.

In making this appeal the fact is recalled that Switzerland is the mother country of the Red Cross, and moreover, notwithstanding her own distress, she has offered to become the hospital for the warring nations and to do all in her power to alleviate the sufferings of those injured in battle; and these things should open the hearts of humanity to assist her not only to carry out her charitable purpose, but to relieve the distress of her people. Contributions should be sent to Swiss Relief Fund, 241 Fifth Avenue, New York, where subscription lists can also be obtained. The necessities and unmerited suffering of our little sister republic should appeal to the sympathies of all Americans.

Esterbrook
Pens
250 styles
The smooth, easy-writing qualities, long wear, and ability to hold a large quantity of ink, are some of the things that have helped to make Esterbrook's Jackson Stub No. 442 the most popular of all stub pens.
Write for illustrated booklet.
Esterbrook Pen Mfg. Co.
New York Camden, N. J.
Ask your stationer
JACKSON STUB
442

Every time you start your car, Friction takes a wallop at the bearings.

DIXON'S
Graphite Lubricants

put a smooth, oily coat of pure flake graphite over bearing surfaces that entirely prevents friction-breeding, metal-to-metal contact.

Equally good for motor boats.

Write for Lubricating Chart.

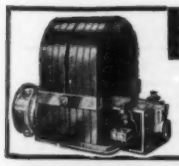
THE JOSEPH DIXON CRUCIBLE CO.
JERSEY CITY, N. J.

Established in 1827

Use KEROSENE Engine Free!

Amazing "DETROIT" Kerosene Engine, 15 days' FREE Trial, proves *kerosene* cheapest fuel. If satisfied, pay lowest price ever given; if not, pay nothing. No waste, no evaporation, no explosion. Two pints of coal oil do work of 3 pints gasoline. Send for FREE Catalogue. Don't buy an engine till you investigate this grand offer. Write

DETROIT ENGINE WORKS
127 Bellevue Ave., Detroit, Mich.



Lighting Generator for Automobiles

Battery charged through cut-out can supply current for lighting direct. No field coils. No failure to generate. Run in either direction. Wiring simple. Send for booklet.

The Holtzer Cabot Electric Co.
Chicago, Ill. Brookline, Mass.

MOTION PICTURE PHOTOGRAPHY

with the **Vista Motion Picture Camera** and **Projector** is as **simple as snapping pictures with a kodak.**

Uses EASTMAN Standard Motion Picture Film

Price of Camera $39.00

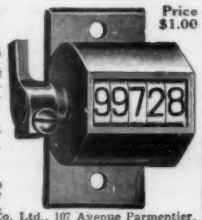
Projecting Attachment Separately Listed

Ask your dealer or write direct for Catalogue 2.

MOTION PICTURE CAMERA CO.
5 West 14th Street New York

VEEDER Counters

Price $1.00



to register reciprocating movements or revolutions. Cut full size. Booklet free.

VEEDER MFG. CO.
18 Sargeant St. Hartford, Conn.

Cyclometers, Odometers, Tachometers, Counters and Fine Castings.

Represented in Great Britain by Markt & Co. Ltd., 6 City Road, Finsbury Sq., London, E.C.; France, by Markt & Co. Ltd., 107 Avenue Parmentier, Paris; Germany, Austria-Hungary and Scandinavian Countries by Ludw. Loewe & Co., Hutten Strasse 17-20, Berlin.

ELECTRIC LIGHTING FOR AMATEURS

How a small and simple experimental installation can be set up at home. Scientific American Supplement 1551. Price 10 cents. For sale by Munn & Co., Inc., and all newsdealers.

Notes and Queries.

Kindly keep your queries on separate sheets of paper when corresponding about such matters as patents, subscriptions, books, etc. This will greatly facilitate answering your questions, as in many cases they have to be referred to experts. The full name and address should be given on every sheet. No attention will be paid to unsigned queries. Full hints to correspondents are printed from time to time and will be mailed on request.

(13018) J. H. I. asks: Can you give me a good formula for carbonizing the tops of tables (wood), and commonly called black acidproofing? If you have no such formula, can you tell me how I can get same? A. You will find a process for a black finish for table tops in our SUPPLEMENT No. 1431, which we have used upon oak laboratory tables with fine results. We will send the paper for ten cents.

(13019) A. L. asks: Will you please explain the undulatory theory of light, and also the theory of emission? Which is more generally accepted? A. The emission theory of light assumes that tiny particles are shot out from all bodies which we can see, and that these entering the eye enable us to see the object from which they come. The undulatory theory assumes that bodies excite waves, which traverse space as waves move over the surface of the water, and that these waves enter the eye, causing vision. These two theories existed together until about 1800, when Fresnel produced the interference of light by apparatus, and thus demonstrated that light is due to a wave motion. The believers in the emission theory had, for about two hundred years, asserted that light waves would interfere and produce darkness by their interference, if light was due to waves. When the dark bands were actually produced by the interference of light, the case was proved that light is due to a wave motion. You can see these dark bands by closing one eye and holding the hand close over the other eye, so that you can see through the narrow space between two fingers looking toward a window. You will see numerous dark lines parallel to the edges of the fingers. These are caused by the interference of the waves of light in passing the edges of the fingers. There are now none left to advocate the emission theory of light. It is dead.

(13020) E. H. C. asks: On page 29 of the fourth edition of Ball's "Mathematical Recreations and Essays," I find the following: "Here is another simple question to which not unfrequently I have received incorrect answers. One tumbler is half full of wine, another is half full of water; from the first tumbler a teaspoonful of wine is taken out and poured into the tumbler containing the water; a teaspoonful of the mixture in the second tumbler is then transferred to the first tumbler. As a result of this double transaction, is the quantity of wine removed from the first tumbler greater or less than the quantity of water removed from the second tumbler? Nineteen people out of twenty will say it is greater, but this is not the case." It is inconceivable that an authority of this weight should have made a misstatement in a book of this character and that it should have passed unchallenged through four editions. Yet it would seem to me to be an incontestable fact that inasmuch as the second transfer is made up of a mixture, the introduction of any portion of a second element—no matter how infinitesimal the quantity—necessarily means the exclusion of a corresponding amount of the first element. I cannot see it in any other light. Will you have the kindness, as briefly as you may see fit, to straighten me out? A. The obscurity in Ball's famous puzzle lies in the indefiniteness of the statement of "quantities." This may easily be removed. Let us assign some definite quantity to each glass, say 9 spoonfuls, and carry the transaction through. It will be more easily followed if put in tabular form.

	Glass of Wine.	Glass of Water.
First step...	9	9
Second step.	8	9+1=10

Note.—The teaspoonful of the mixture which is returned to the glass of wine contains 1/10 teaspoonful of wine and 9/10 teaspoonful of water, so that the two tumblers contain after the second transfer:

	Wine.	Water.	Water.	Wine.
Third step..	8 1/10	+9/10=9	8 1/10	+9/10=9

It is seen that 9/10 of a spoonful of each liquid has been transferred from each glass to the other, and the statement of Prof. Ball is correct. Of course the result would be the same whatever the numbers assumed. We assumed 9 simply because it gave tenths in the final result.

(13021) C. A. C. asks: I have often been told that corn meal ground on a stone is a better grade than if ground on a steel burr mill. Is this true, and if so, what is the difference? A. The housewife in our family says it is true that corn meal ground on a stone is better than that ground in a steel mill. The reason given is that the meal ground with stones is finer and more uniform.

(13022) D. L. M. asks: Would like dry air for photo dark room. A. It will not be possible to have the air of a photographic dark room dry, unless water is excluded from the room. Even then some dryer would be necessary. Several pans of fresh unslaked lime around the room will be the cheapest and simplest mode of absorbing the moisture from the air. Even then the air would not remain dry with a person in the room. We exhale much moisture in the breath.

IF you were **denied college training** but have reached a place where something of the kind seems necessary to your further advancement in the mine, the mill, the shop, or the smelter you should know about the special short courses which the

Michigan College of Mines
at Houghton, Michigan

is offering this year, arranged with particular reference to your needs

They are short practical courses in mining, metallurgy, drawing, mapping, concrete construction, and many others.

Write the president of the College telling him what part of the year you can attend, what your work has been, and what you wish to do.

MAXIM SILENCER

Enjoy Noiseless Shooting

You can hold target practice or shoot noiselessly anywhere by fitting your rifle with a Maxim Silencer. It's fine for hunting because there is no report noise to frighten game. Improves marksmanship—reduces the recoil and stops flinching.

WRITE FOR FREE BOOK

Filled with interesting experiences of sportsmen with the Maxim Silencer—stores of actual recordsthat will surprise you. Ask your dealer for a Silencer. If he has none, tell us his name and we will arrange to supply you.

MAXIM SILENCER CO.
94 Huyshope Ave., Hartford, Ct.

Shirley President Suspenders 50¢

Rest the shoulders—cannot press or chafe

"Satisfaction or money back"

Be sure "Shirley President" is on buckles
The C. A. Edgarton Mfg. Co., Shirley, Mass.

LEARN TO BE A WATCHMAKER

Bradley Polytechnic Institute—Horological Department

Peoria, Illinois

Largest and Best Watch School in America

Formerly Parsons Horological Institute

(This entire building used exclusively for this work)

Largest and Best Watch School in America

We teach Watch Work, Jewelry, Engraving, Clock Work, Optics. Tuition reasonable. Board and rooms near school at moderate rates. Send for Catalog of Information.

Strengthen YOUR Will

Over 25000 People Already Use This Book

"Power of Will"

By FRANK CHANNING HADDOCK, Ph. D., M. S.

Frank Channing Haddock, Ph. D., M.S., is one of the most inspiring writers on Practical Psychology now living. His work glows with a deep, splendid, heartening philosophy that ranks him with James Bergson, Eucken and Royce as a twentieth-century leader of thought

Partial List of Contents

- How to Develop Analytical Power
- How to Concentrate—Detailed Directions
- How to Throw off Worry
- How to make the Will Supreme
- How to Overcome Indecision
- How Permanent Influence Over Others is Secured
- Fifty-Four Rules to ControlOther People
- How to maintain the Central Factors of Bodily Health
- How to Secure Steady Nerves
- First Principles of Success
- How the Will Acts
- How to Test Your Will
- Methods of Developing Will
- Principles of Drill for Mental Power
- How to Increase Powers of Observation
- How to Develop aKeen Gaze
- How toTrain the Senses
- Law of Will Power in Habits
- How to Master Habit
- How to Master Anger
- The Mental Law of Habit Cure
- How to Develop Memory
- How to Banish Fear
- How to Overcome Hesitation in Speech
- How to Overcome Unhealthy Mind States
- How to Overcome Stage Fright and Embarrassment

etc., etc. etc.

Sent on Free Trial for Five Days

This great work on practical psychology provides a *thorough scientific course in Will-training*, consisting of 28 lessons. Its results have bordered on the marvellous.

It has come as a vital force into the lives of thousands of people, showing how *to make their brains serve them better*—making them more dominant in their dealings—giving them a sure, masterful grip upon their life problems.

It has proved a veritable well of strength for people afflicted with ill-health and nervous weakness. It has *reawakened ambitions* in men and women who have been turned from their life purposes—and has shown its students how to CARRY FORWARD those ambitions into consummation.

Helps Everybody

The readers of this book talk of it as a Bible. They range from great captains of industry to clerks. They include physicians, lawyers, artists, writers and advertising men of renown.

It is owned, read, prized and praised by such men as Judge Ben B. Lindsey; Supreme Court Justice Parker; Wu Ting Fang, ex-U.S.Chinese Ambassador; Lieut. Governor McKelvie of Nebraska; Asst. Postmaster General Britt; General Manager Christeson of Wells-Fargo Express Co.; E. St. Elmo Lewis of Burroughs Adding Machine Co.—and literally thousands of other men of action and ambition like them who realize the value of DOMINATING WILL in daily life.

How to Develop Indomitable Will

"Power of Will" is not a book of idle essays. *It sets forth actual methods, plans and principles for training, strengthening and developing Will Power.* These methods are based on one of the most profound scientific analyses of Will Power ever made.

Modern Psychology has indisputably established that the Will can be trained INTO WONDERFUL POWER, like any other human faculty, *by intelligent exercise and use.* A man can make what he wills of himself. He can open up slumbering, DORMANT mental powers. He can develop wonderful faculties, now yielding the merest fraction of their power. He can actually alter the physiological formation of his brain, by means of his Will. This is not a theory, it is a proven fact.

And the value of this great work is that IT SHOWS YOU JUST HOW TO DO THIS FOR YOURSELF—in clear, stimulating lessons, which anybody can understand.

Is YOUR Will Dormant?

Look back upon your life. Once upon a time, no doubt, you weaved great dreams of what you were going to make of yourself. *Are they accomplished now?* Why are they not accomplished? Is it not because you lacked a strong, powerful, dominating, inflexible WILL? You allowed *others* to control and influence you to their ends, instead of controlling others yourself. You let insignificant daily incidents everlastingly turn you from your purpose. Gradually—like so many of us—you allowed this God-given faculty of will to become scotched and DORMANT in you. Dr. Haddock has a message for you—*a real message of emancipation from the blasting human curse of indecision and blind habit.*

Send No Money—Examine Book First

The price of "Power of Will" is $3.00. Let us send you the book. Look it over. Glance through some of the chapters. Judge for yourself whether you can afford *not* to own it. **Send no money now.** Simply send the attached coupon enclosing your business card, *or giving a reference.* You can keep it five days. If at the end of five days, you do not want it, mail it back. Tear out the coupon now, before you turn the page and forget.

Pelton Publishing Co.

219 Wilcox Block

MERIDEN - CONN.

What Readers Say

Hosts of readers of this book have written their thanks and gratitude to Dr. Haddock. Below are a few extracts of some of the letters, which now make a mass six feet high. These extracts serve, at least, to indicate how inspiring and helpful "Power of Will" is.

"In it I found the rules and principles that make it worth its weight in gold."—Dist. Atty. Goodwin, Oil City, Pa.

"I have your 'Power of Will' and would not take $100 for it."—J. A. Wagner, Sec'y-Treas. Toronto Academy of Music, Edmonton, Can.

"Better than anything I have met in FORTY YEARS' study of these subjects, I am certainly grateful to secure this book."—Rev. Wm. H. Barnes, 612 N. 43d St., West Philadelphia, Pa.

"Only wish I had a little of this knowledge years ago."—H. W. Osborn, Office of the Sec'y, Gov't Porto Rico.

"I consider 'Power of Will' invaluable to the systematic and thorough student in any walk of life."—Dr. Wm. Ground, Ex-Pres. Wis. State Med. Assoc.

"Has startled thinking men all over the world. If you want to know what you are, or can be,—get it. It opens up a new world."—James F. Ells, Pres. National School of Salesmanship.

"The five day examination period allowed by you is certainly long enough to convince any one that this is a book one needs. My enthusiasm is beyond description."—Roy S. Tharp, Passenger Dept., Southern Pacific R.R. Co., Oakland, Cal.

"I would not willingly separate myself from it."—Charles W. Merns, Adv. Mgr. Winton Motor Car Company, Cleveland, Ohio.

219
Pelton Publishing Company,
Wilcox Block,
Meriden, Conn.

Gentlemen:—Please send me a copy of "Power of Will" without charge. I agree to remit $3.00 or remail the book in 5 days.

Name .....

Street .....

City ..... State .....

Read the New Novel by the Author of

"QUEED"

and "V.V'S EYES"

of which 400,000 copies already have been sold

IF YOU learned to love "Queed" and have lost yourself in the joyful pages of "V.V's Eyes," Harrison's new novel, **"Angela's Business,"** is for you. It begins in the October

METROPOLITAN

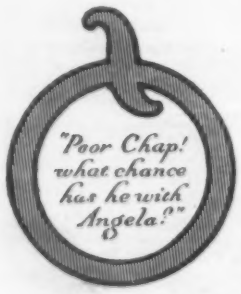
"The Livest Magazine in America"

"Angela's Business" repeats all the charm and humor of the earlier books. But this time Mr. Harrison has written a love story so original and ingenious in its plot—and so important—that you will follow it with the piqued interest of a riddle. And it will set women readers by the ears.

A young author starts out, with all the enthusiasm of youth—and lack of experience—to solve the great mystery of Woman and her Destiny. At the very outset of the quest, he himself falls headlong into his problem and all because of two real women, whose contrasted types send his heart groping as well as his head. Of course he falls in love; of course he wins a woman.

But—what kind of woman is the right kind of woman?

A great American story of today is "Angela's Business," told with the charm of Locke and the shrewd insight of Bernard Shaw.



Here are a few of the interesting features in the October Metropolitan:

Really big fiction by Booth Tarkington; W. W. Jacobs; Larry Evans; Earl Derr Biggers, and the first of a series of great double-barrelled detective stories by Max Pemberton and G. K. Chesterton.

Live Features

"The Correspondent and the Englishman," by John Reed (Metropolitan's war correspondent now in Europe).

"The United States of South America," by Granville Fortescue.

"What I saw in Liege"—An eye witness' story.

Six big art pages of rotary gravure

In the October Metropolitan—**on all good newsstands—15 cents**

NEW BOOKS, ETC.

EUGENICS. Twelve University Lectures. By Morton A. Aldrich, William Herbert Carruth, Charles B. Davenport, Charles A. Elwood, Arthur Holmes, W. H. Howell, Harvey Ernest Jordan, Albert Galloway Keller, Edward L. Thorndike, Victor C. Vaughan, Herbert John Webber, Robert H. Wolcott. New York: Dodd, Mead & Co., 1914.

The value of these lectures, selected from among a number given in various universities and colleges throughout the country in the scholastic year of 1912-1913, lies not so much in any new facts which they bring out as in the singular unanimity which exists in the minds of scientific men working in widely different fields on the value of eugenics. When zoologists, physicians, physiologists, sociologists and psychologists agree on the enormous influence exerted by heredity in shaping the destinies of human beings, eugenics pass out of the realm of theory into that of fact. The more widely books and collections such as this are read, the sooner will the public conscience be awakened to the necessity of passing appropriate legislation. Eugenics in the Mendelian sense of the term is hardly ten years old; yet in that brief span much valuable work has been done, which must convince every right-thinking man what a menace bad protoplasm is to society. Every one of the lecturers whose work is to be found in this book is a leader in his special province, and a book by twelve leaders surely must command attention.

CRIME AND ITS REPRESSION. By Gustav Aschaffenburg, Professor of Psychiatry in the Cologne Academy of Practical Medicine. Translated by Adalbert Albrecht, Associate Editor of the *Journal of Criminal Law and Criminology*. With an Editorial Preface by Maurice Parmelee, Associate Professor of Sociology in the University of Missouri. And an Introduction by Arthur C. Train, Former Assistant District Attorney for New York County. Boston: Little, Brown & Co., 1913. 8vo.; 331 pp. Price, $4 net.

CRIMINOLOGY. By Baron Raffaele Garofalo, Procurator General at the Court of Appeals of Venice and Senator of the Kingdom of Italy. Translated by Robert Wyness Millar, Lecturer in Northwestern University Law School. With an Introduction by E. Ray Stevens, Judge of the Circuit Court, Madison, Wis. Boston: Little, Brown & Co., 1914. 8vo.; 478 pp. Price, $4.50 net.

"The Modern Criminal Science Series" is a library of translated works, by means of which the American Institute of Criminal Law and Criminology are making accessible to American readers the researches and opinions of European authorities. The works listed above are volumes VI and VII of the series. Gustav Aschaffenburg is well known in Germany as a scholarly investigator who brings medicine and psychiatry to the aid of law and order. "Crime and Its Repression" presents a wealth of reliable statistics bearing upon crime and its causes in Germany. It does more. To collate such data is one thing; correctly to analyze them and to construct working principles from that analysis is distinctly another and higher achievement. The volume is replete with citations from past and present authorities, and the author with equal fluency and vigor supports them, combats them or supplements them by his own keen insight and constructive genius. He discusses alcoholism, prostitution, gambling, and such kindred obsessions as lead to crime in the individual and in the offspring. Seasonal, occupational, racial, and religious factors are weighed; economic conditions are the subject of careful deliberation. He then comes to a consideration of prevention, purposes and means of punishment, and the vicious tendencies of the fixed term. Finally, he summarizes the fundamental principles upon which all penal methods should be based.

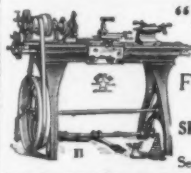
"Criminology" is a lucid piece of writing which shows decided Anglo-Saxon influences. Indeed, there is danger that its simple style may blind us to the real depth of its foundations and the strength of its position. The criminal is made the subject of a painstaking examination in the light of his acts, his attitude, and the various influences of heredity and environment that have largely contributed to make him what he is. The laws then come in for their share of criticism; the theories upon which they are based are expounded and the defects of existing procedure frankly pointed out. Under "The Rational System of Punishment" crimes are classified, and an attempt made to fit the punishment to the responsibility and to make it regenerative rather than destructive.

A PRIMER OF HIGHER SPACE. (The Fourth Dimension.) By Claude Bragdon. Rochester, N. Y.: The Manas Press, 1913. 8vo.; 79 pp.; illustrated. Price, $1.

A point in motion indicates a line; a line moving at right angles to itself indicates a rectangle; while the rectangle moving at right angles to its plane indicates a solid. The author seeks to continue this process into a fourth dimension, and to so state his facts and analogies that the most non-mathematical reader may glimpse the reasons behind the idea. With no claim on the author's part to contribute anything new to this interesting discussion, he has justified his title. The work reprints Mr. Bragdon's imaginative allegory, "Man the Square," in which the four-dimensional theory is applied to the solution of several of life's mysteries.

ADVERTISING CLASSIFIED

LATHES AND SMALL TOOLS



"STAR" Foot and Power Screw Cutting Automatic Cross Feed LATHES
For Fine, Accurate Work
Send for Catalogue B
SENECA FALLS MFG. CO.
695 Water Street
Seneca Falls, N. Y., U. S. A.

LATHES for automobile and general repair work. "SEBASTIAN" Lathes are best. Drop a card for our latest catalog.
THE SEBASTIAN LATHE CO., 120 Culvert St., Cincinnati, O.

Friction Disk Drill
FOR LIGHT WORK
Has These Great Advantages.
The speed can be instantly changed from 0 to 1500 without stopping or shifting belts. Power applied can be graduated to drive, with equal safety, the smallest or largest drills within its range—a wonderful economy in time and great saving in drill breakage.

Send for Drill Catalogue
W. F. & Jno. Barnes Company
Established 1872
1999 Ruby Street Rockford, Illinois

GROBET SWISS FILES and other high-class Tools are shown in "THE TOOL-MONGER"—its 462 pages, and will be mailed on receipt of 8 cents in stamps.
MONTGOMERY & CO.
105 Fulton Street New York City

"Red Devil" Side Cutter
No. 50
DROP FORGED—HAND HONED
New style dentyne-milled handles of latest scientific shape. At your dealer, or send 75 cents sample 6-inch size. Send for booklet of "1000 Red Devils" anyhow.
SMITH & HEMENWAY CO., Inc.
155 Chambers St., N.Y. City

WELL DRILLING MACHINES
Over 70 sizes and styles, for drilling either deep or shallow wells in any kind of soil or rock. Mounted on wheels or on sills. With engine or horse powers. Strong, simple and durable. Any mechanic can operate them easily. Send for catalog.
WILLIAMS BROS., Ithaca, N. Y.

GRITS FOR EVERY GRIND
We operate 20 grindstone quarries, and produce a great variety of grits. Our expert graders select exactly the right grit for your work.
CLEVELAND GRINDSTONES
for mechanics, machinists and industrial schools. Largest production. Guaranteed even grit. Write for catalogue.
THE CLEVELAND STONE CO.
1129 Leader-News Bldg., Cleveland, O.

SPECIAL MACHINERY

MANUFACTURING SERVICE
DIES, STAMPINGS, PARTS, ASSEMBLING
Big, Successful, Experienced Concern.
THE GLOBE MACHINE & STPG. CO., Cleveland

Models and Experimental Work
INVENTIONS DEVELOPED
SPECIAL MACHINERY . . .
E. V. BAILLARD CO., 24 Frankfort St., N. Y.

WRITE FOR BOOKLET OF
INVENTOR'S SUPPLIES
UNION MODEL WORKS
Established 1882 119 S. Clark St., Chicago
The oldest, most reliable, most efficient model making and experimental house in the west

CLOCK MOVEMENTS
Spring motors and parts manufactured
Fine Die and Tool Work.
MODEL AND EXPERIMENTAL WORK
LUX CLOCK COMPANY, Waterbury, Conn.

NOVELTIES & PATENTED ARTICLES
MANUFACTURED BY CONTRACT. PUNCHING DIES.
LIGHT AUTOMOBILE STAMPINGS
E. KONIGSLOW STAMPING & TOOL WORKS, CLEVELAND, O.

LUBRICANTS

LUBRICATES ANYTHING SEND FOR SAMPLE FREE
118-124 North Clinton St. CHICAGO, U.S.A.
CHARLES A. VACUUM OIL CO.

A Home-Made 100-Mile Wireless Telegraph Outfit ¶ Read Scientific American Supplement 1605 for a thorough clear description, by A. Fred'k Collins. Numerous adequate diagrams accompany the text. Price 10 cents by mail. Order from your newsdealer or from MUNN & CO., Inc. 361 Broadway, New York

War Issue No. 2

of the

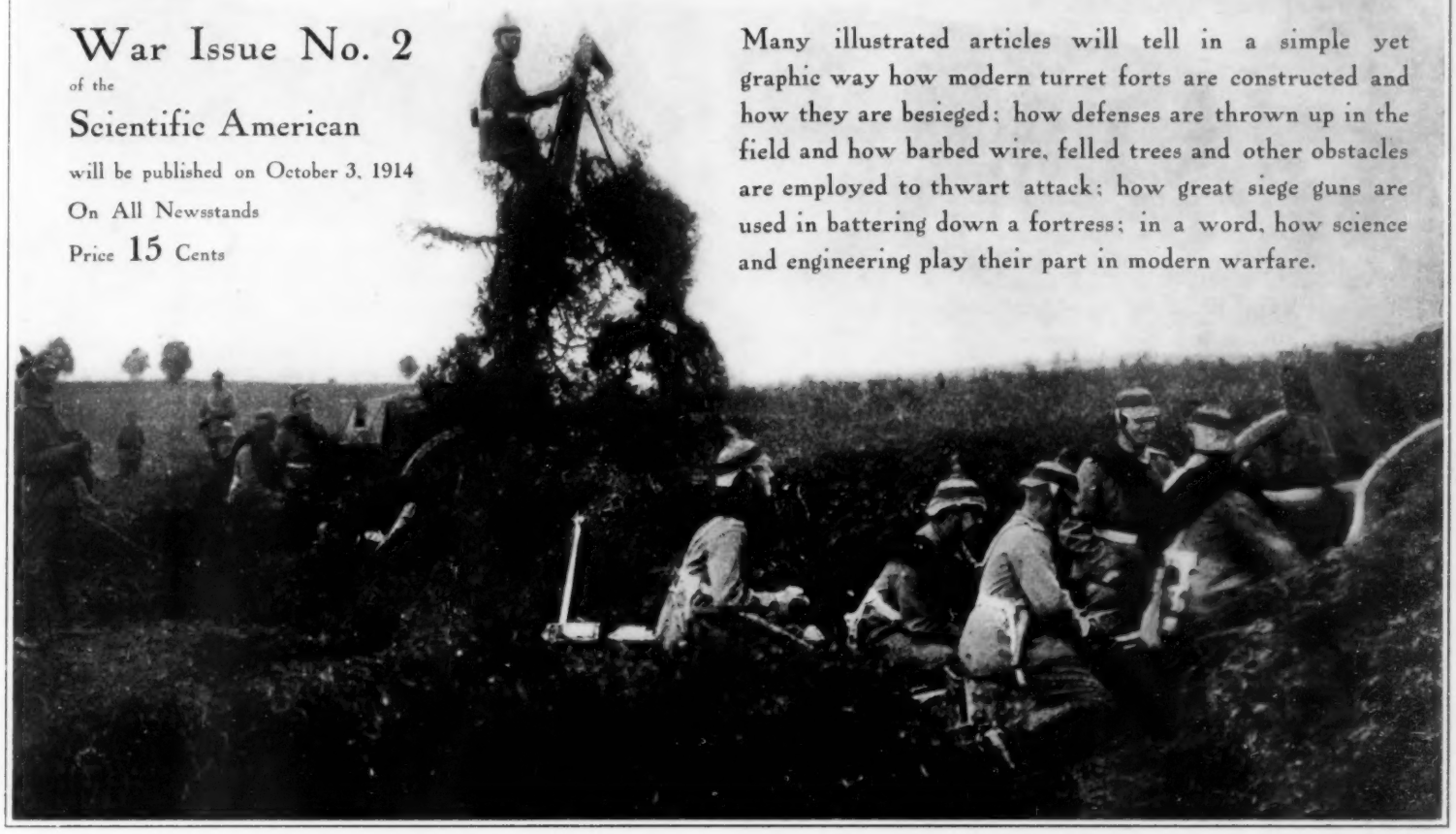
Scientific American

will be published on October 3, 1914

On All Newsstands

Price 15 Cents

Many illustrated articles will tell in a simple yet graphic way how modern turret forts are constructed and how they are besieged; how defenses are thrown up in the field and how barbed wire, felled trees and other obstacles are employed to thwart attack; how great siege guns are used in battering down a fortress; in a word, how science and engineering play their part in modern warfare.



DAY after day the Germans pumped shot and shell upon the fortifications of Liege. But the forts held out bravely. "Wait until our heavy siege artillery comes," said the Germans. When it came, the forts crumbled.

They must have been very wonderful forts that could hold out so dauntlessly, and they must have been very wonderful guns that ultimately reduced them. In the October 3rd issue of the SCIENTIFIC AMERICAN you will learn all about these forts (there are many more like them along the French-Eastern frontier), and all about the big guns that cracked them.

The Gruson Turret Fort

Military men call these Liege defenses and others of their type "Gruson Turret Forts." Curiously enough they are of German design, and fittingly enough it took German guns to reduce them.

Major A. Piorkowski, a well-known German expert on ordnance, has written, for the October 3rd issue of the SCIENTIFIC AMERICAN, a very instructive article on this Gruson Turret Fort. He takes you by the hand, as it were, and leads you through underground passages to the ammunition hoists, and eventually into the steel turret itself, and shows you its operating mechanism and its powerful weapons.

Huge Siege Guns of the Germans

The huge siege guns before which the turret forts succumbed will receive their attention in another article. In a magnificent colored cover, which will enclose the entire issue, one of these destructive giants is pictured in action. The issue will also present other pictures of siege artillery, and will explain in the SCIENTIFIC AMERICAN'S characteristically lucid way what may be expected of them.

Fortifications in the Field

How was the German onslaught met in pitched battle? Defenses of some kind, as well as gun fire, were necessary. Every obstacle that can be conceived was thrown into the path of the onrushing German infantry. The barbed wire fence and felled trees with great protruding branches must have proved formidable barricades. The full nature of these defenses, which make it as necessary for an infantry man to carry wire cutting tools as guns will be set forth.

Submarine Mines and How They Are Constructed

Perhaps a dozen or more neutral merchant vessels have been blown up by mines in the North Sea. They are terrible instruments of destruction, these mines. A tramp steamer, or a battleship for that matter, steams along through a sea that betrays nothing of the explosives hidden beneath its waves. Suddenly the ship's bottom touches the top of the mine. It is as if the trigger of a gun loaded with hundreds of pounds of deadly explosives had been pulled. The explosion is terrific; the destruction complete. How are these mines constructed? Why are they so deadly? The SCIENTIFIC AMERICAN'S war issue No. 2 will tell.

The Mechanism of a Submarine Boat

The submarine boat will also receive its share of attention; for the submarine is bound to play its part in the present conflict. As you read the SCIENTIFIC AMERICAN'S article on submarines, their intricate mechanism will be picked apart for you, as it were, just as if they were so many watches. Engines, trimming tanks, periscopes, torpedo tubes, in a word, all the wonderfully compact machinery of the submarine will be revealed.

There will be other articles too, in this issue—articles of a constructive nature.

Our Trade Opportunity

John Barrett, director of the Pan-American Union, will point out to the American exporter just what the war has done for him in opening up foreign markets that have hitherto been closed to Americans. Letters from prominent financiers, business men manufacturers, will also be published—all of them men worth heeding—whose opinions will form a fitting supplement to Mr. Barrett's exposition.

An Eight Cylinder Cadillac

The matchless mode of motoring reserved to only a few privileged persons in the Old World (at an almost prohibitive price) developed by the Cadillac Company for American motorists!

Serious minded motor car manufacturers have sought the ideal power principle for fifteen years.

The Cadillac Company has never relaxed for a month, a week, or a day, its patient pursuit of that underlying principle which would prove to be ultimate and final.

In the course of that long journey toward perfection, the Cadillac Company has given serious consideration to every reputable type of motor—endeavoring to scrutinize with scientific impartiality the virtues and the limitations of each and every one alike.

Building and experimenting in turn, with every type from the single cylinder to the six, and from the poppet to the rotary and to the sliding valve, we have been carried forward irresistibly, by the impetus of our own research, to the highest form of frequent-impulse motor—the V Type Eight Cylinder.

It is admitted, we believe, that this Company produced in the four cylinder field, a succession of cars which earned the title "Standard of the World."

Beyond that, loomed for us only one hope and possibility—the promise of a motor in which there would be *no* lapse, *no* pause, *no* hesitation between impulses, but an overlapping of strokes so complete as to produce a flow of power almost literally liquid in its continuity.

We sought the medium by which the Cadillac would be endowed, not with *approximate* freedom from gear shifting, or *approximate* hill-climbing ability on high, or *approximately* swift acceleration, but with the *highest possible form* of these three characteristics.

The Cadillac already possessed those qualifications in an extraordinary measure, but we wanted them developed to a point *beyond which it was not possible to go.*

This requirement pointed straight to an Eight Cylinder Cadillac with four power impulses during every revolution of the fly-wheel.

How fully these luxuries of travel have been achieved, nothing but your first memorable ride in the new Cadillac can reveal.

As the Cadillac softly speeds along under the almost magic influence of this new power-principle, you become oblivious to the wonderful mechanism which gives you motion. The sensation is as unique as though you had never motored before—the sense of floating through space comes to you as it never came to you before.

It is useless to try to depict in words, thrills which you have never felt—or to portray a degree of ease which you have never experienced.

Good roads yield up a velvet quality of travel undreamed of.

Bad roads lose much of their terror, and hills seem almost to flatten out before you—so easily, so quietly, and with so little effort does the car surmount them.

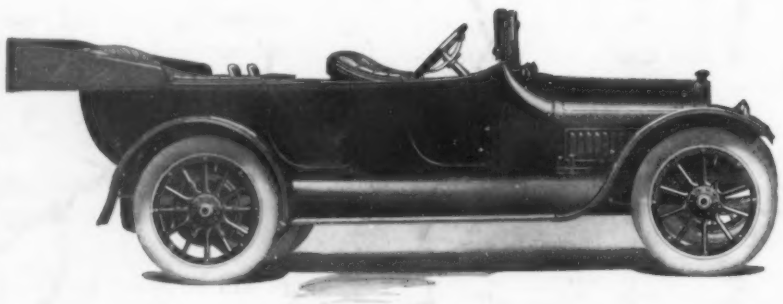
In operation, you enjoy the extreme of flexibility—from less than three miles an hour in crowded city streets and congested traffic to more than sixty miles an hour on the open highway, without change of gears.

Comfort is subserved in the highest degree by the absence of vibration and the pronounced flexibility—and, again, by the yielding springs; the ease with which the car is handled and controlled; the smoothness of the worm bevel driving gears, the soft clutch action and the exceptional sense of rest and relaxation.

The supreme motoring experience of your life awaits you when you take your first ride in this truly remarkable car.

Styles and Prices

Seven Passenger and Five passenger cars, Four passenger Salon and Roadster, $1975. Landaulet Coupe, $2500 Five passenger Inside Drive Limousine $2800. Seven passenger Standard Limousine $3450. Berline type Limousine $3600. Prices F. O. B. Detroit.



Seven Passenger Touring Car (illustrated) with Eight Cylinder V Type Engine.

Observe that the Power Plant does not demand a hood of abnormal proportions.

Dealers will have demonstrating cars in the near future

Cadillac Motor Car Co. Detroit, Mich.